Volume 4 Chalk to Czechoslovakia

The GOLDEN BOOK ENCYCLOPEDIA

REVISED EDITION

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The GOLDEN BOOK ENCYCLOPEDIA

NEW REVISED EDITION

VOLUME 4—CHALK TO CZECHOSLOVAKIA

IN SIXTEEN ACCURATE, FACT-FILLED VOLUMES
DRAMATICALLY ILLUSTRATED WITH MORE
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TO MAKE LEARNING AN ADVENTURE

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Chalk
to
Czechoslovakia

CHALK Countless millions of tiny organisms too small to be seen without a microscope live in the sea. Some of them have the long name of foraminifera (for e mi NIF e ra). They belong in the group of living things called protozoa. Under a microscope foraminifera look like jewels. Each one has a beautiful little shell which it has made for itself.

There are different kinds of foraminifera. They do not all make their shells of the same material. But a great many make their shells out of lime from the water. When they die, their bodies decay and their shells are left behind.

Foraminifera have lived on the earth for many, many millions of years. In some places long ago they lived in such numbers that their shells made layers hundreds of feet thick on the floor of the sea. In time these layers became layers of white rock. This white rock is a kind of limestone that we call chalk.

The famous white cliffs at Dover in England are made of chalk. There are layers of chalk in Kansas and other places far away from the sea. These chalk layers show that there were once seas where there is dry land today.

Chalk is used in making putty and paint. It is used in toothpaste and soft polishing powders. Some cement is made of it. Many farmers use it as a fertilizer.

But to many people the word "chalk" means only crayons for writing on blackboards. Long ago people found out that chalk is soft enough to be used to write with. And for many years almost all blackboard crayons were made of it. Few children who used these crayons guessed that they were writing with the shells of tiny creatures of long ago. Today other materials have largely taken the place of chalk in blackboard crayons, just as other materials have replaced slate in blackboards.

CHARIOT No one sees chariots today except in museums or, perhaps, in circuses. But once they were used a great deal. Chariots were the very first wheeled vehicles. Sumerian warriors were riding them

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into battle 5,000 years ago. Ancient pictures show war chariots drawn by donkeys. The drivers are standing up, for there are no seats. There are no backs, either.

In the 18th century B.C. Egypt was conquered by people from Asia. The Egyptian soldiers fought on foot. The enemy rushed on them in chariots drawn by horses. The Egyptians had never seen horses or chariots before. In time the Egyptians drove out their conquerors. But they kept the idea of using chariots in war.

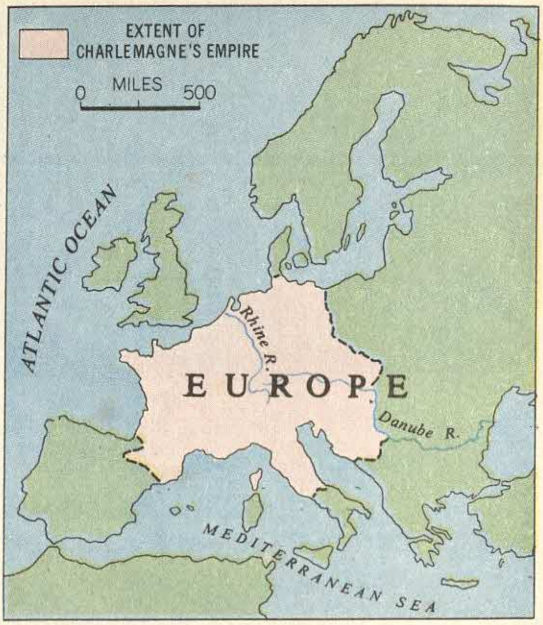
In ancient times chariots were used in processions, too, and in hunting. Chariot racing was an important part of the Olympic games of ancient Greece, and of the Roman circuses. The book *Ben-Hur* tells a thrilling story of a Roman chariot race.

The Greeks and Romans thought that their gods sometimes rode in chariots. The sun moved from east to west, they believed, because the god of the sun drove across the sky each day in a chariot of gold.

Charlemagne Being Crowned Emperor

CHARLEMAGNE (SHAR le mane) (742–814) The name Charlemagne means "Charles the Great." It is one of the few great names that have come down to us from the Dark Ages.

When he was 26 years old, Charlemagne became king of the Franks. He fought many battles to make his kingdom larger, and to spread Christianity, too. The Pope was grateful. On Christmas Day in the year 800, at St. Peter's in Rome, Pope Leo III crowned Charlemagne emperor. The coronation marked the beginning of what came to be known as the Holy Roman Empire, which lasted a thousand years.



As emperor, Charlemagne did many things for his people. He was always ready to hear their troubles and to right them if he could. Above all, he did much to interest his people in learning. He started schools, one of them in his own palace. He brought in from other countries many learned men as teachers. Some of the boys who came to school were sons of rich nobles. They thought that they did not have to study. Charlemagne saw to it that they changed their minds.

Charlemagne could read, but he could not write. He kept a tablet under his pillow so that he could practice writing whenever he could not sleep.

After his death, many stories, some partly true and some entirely made up, were told about Charlemagne and his warriors. In time the stories were written down. One of them, *Chanson de Roland (Song of Roland)*, written in the early 12th century, is among the first stories ever written in French. (See DARK AGES; FRANCE; MIDDLE AGES; ROLAND.)

CHEESE An Arab once filled a pouch made from a calf's stomach with fresh milk and started on a long journey across a hot desert. With each step the pouch swung from side to side. When the Arab stopped to drink from the pouch, he found, instead of milk, a solid mass which did not taste like anything he had ever eaten.

This is only a make-believe story, but it shows how the first cheese may have been made. We know that rennet, important in the digestion of food, is found in the stomachs of many animals. We know, too, that rennet will turn milk to cheese.

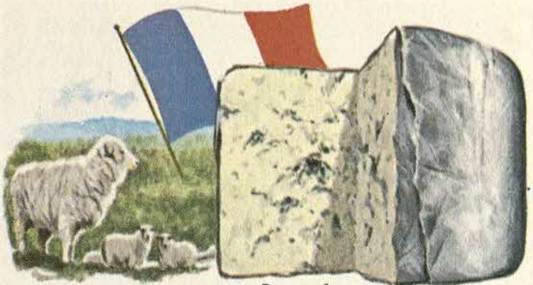
Cheese is the solid part of milk. It is mostly fat and protein. Cheesemakers, by adding rennet or acid or by letting bacteria sour the milk, make the solids of the milk come together in curds. The liquid part, or whey, is drained off. Cottage cheese is a mass of small fresh curds.

There are many kinds of cheese. The kind is determined by the kind of milk used and by what is done to the curds. Cow's milk, sheep's milk, camel's milk, mare's milk, or goat's milk may be used. Most kinds of cheese are allowed to ripen, some for a much longer time than others. Special kinds of mold or bacteria are added to give special flavors.

Roquefort cheese is called the "king of cheeses." It is made in or near Roquefort, France. This famous cheese is streaked with a blue-green mold that grows in it. Roquefort cheese is made from sheep's milk. Cheese much like it is made in the United States from cow's milk and is called blue cheese. Some other famous cheeses are Cheddar, first made in England, Edam from the Netherlands, and Mozzarella and Parmesan from Italy.

Biggest of cheeses are the giant cheese wheels made in Switzerland. Some weigh as much as a ton.

Cheese is a good food because it has in it almost everything that is in milk. Many people live on a diet largely of cheese, black bread, and fruit.

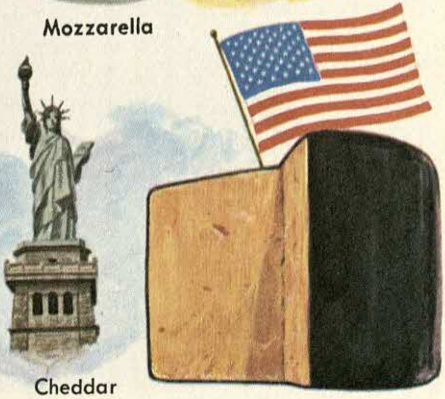


Roquefort

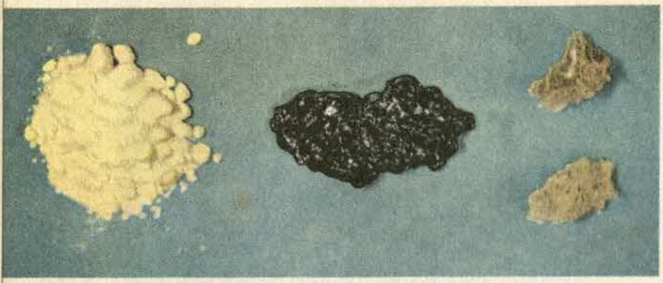
Edam

Swiss

Mozzarella



Cheddar



Sulfur does not always look the same.

CHEMISTRY For many hundreds of years people have been curious about what things are made of. It has not been enough for them to know that a house is made of bricks. "What are the bricks made of?" they ask. Finding out that the bricks are made of clay is not enough either. "What is clay made of?" they then want to know. Such curiosity led to the science of chemistry. Chemistry is the study of what things are made of.

Chemists have discovered that everything in the world is built of only about 100 simple substances. They call these simple substances elements. One of the jobs of chemists is to find out what elements different substances have in them. They have found, for example, that sulfur is an element. They have found that cane sugar is a compound of three elements—carbon, hydrogen, and oxygen. They know that milk is a mixture of a number of compounds and that one of them contains calcium, an element our bodies must have.

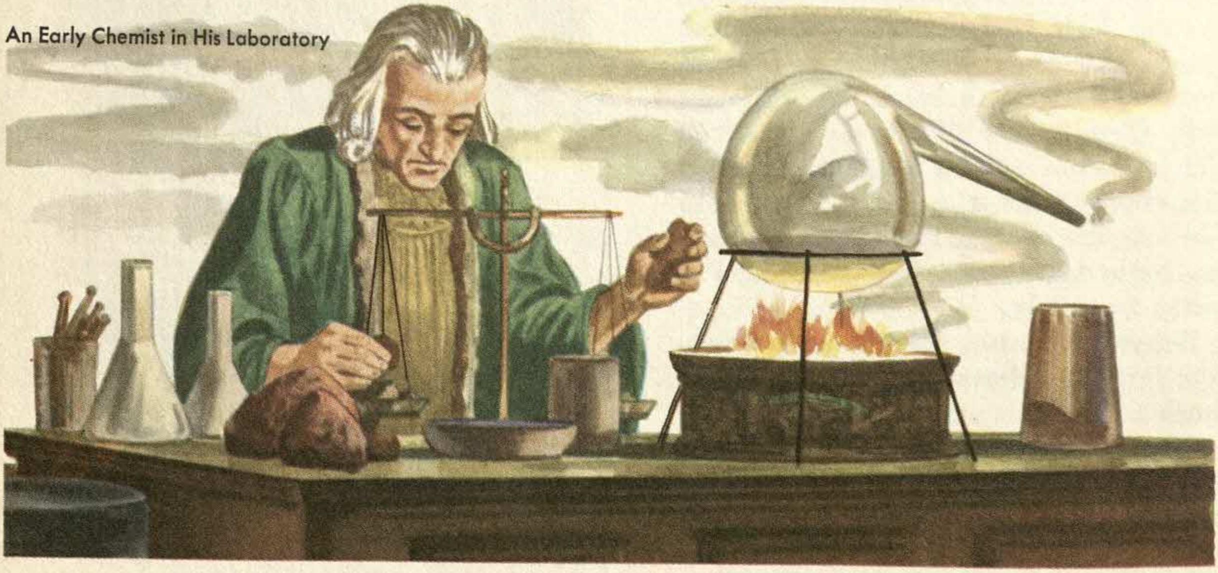
But chemists do much more than tear substances apart to find out what elements are in them. They explain chemical changes, too. And they find ways of producing useful new substances.

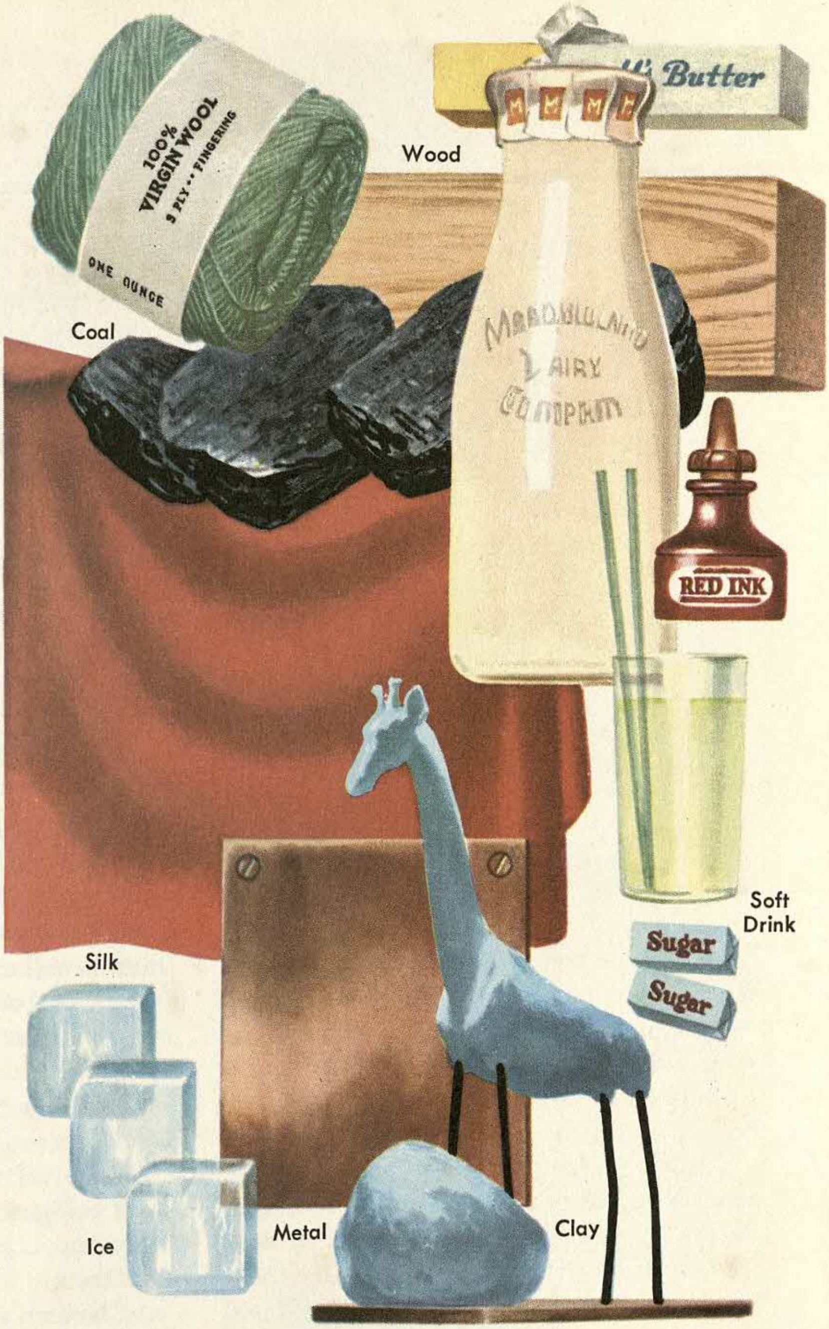
A change is a chemical change when the materials at the end are different from those in the beginning. A baby drops his cup of milk. The china cup breaks, and the milk spills over the floor. The cup is ruined. But the china in the pieces is still china. The milk is ruined, too, but it is still milk. A piece of paper falls into the fireplace by mistake and catches fire. The paper is ruined. But the change in it is not like the change in the milk and the china. The paper is no longer paper. In place of the paper there are a few ashes and some invisible gases that escape into the air. Burning is a chemical change.

Chemical changes go on around us all the time. Iron rusts. Colored cloth fades. Milk sours. Apples rot. Green plants make food out of materials from the air and the ground. All these are chemical changes.

Chemical changes are also going on inside our bodies every minute that we live. Some of the food we eat is being made over into muscle and blood and bone. Some of it

An Early Chemist in His Laboratory



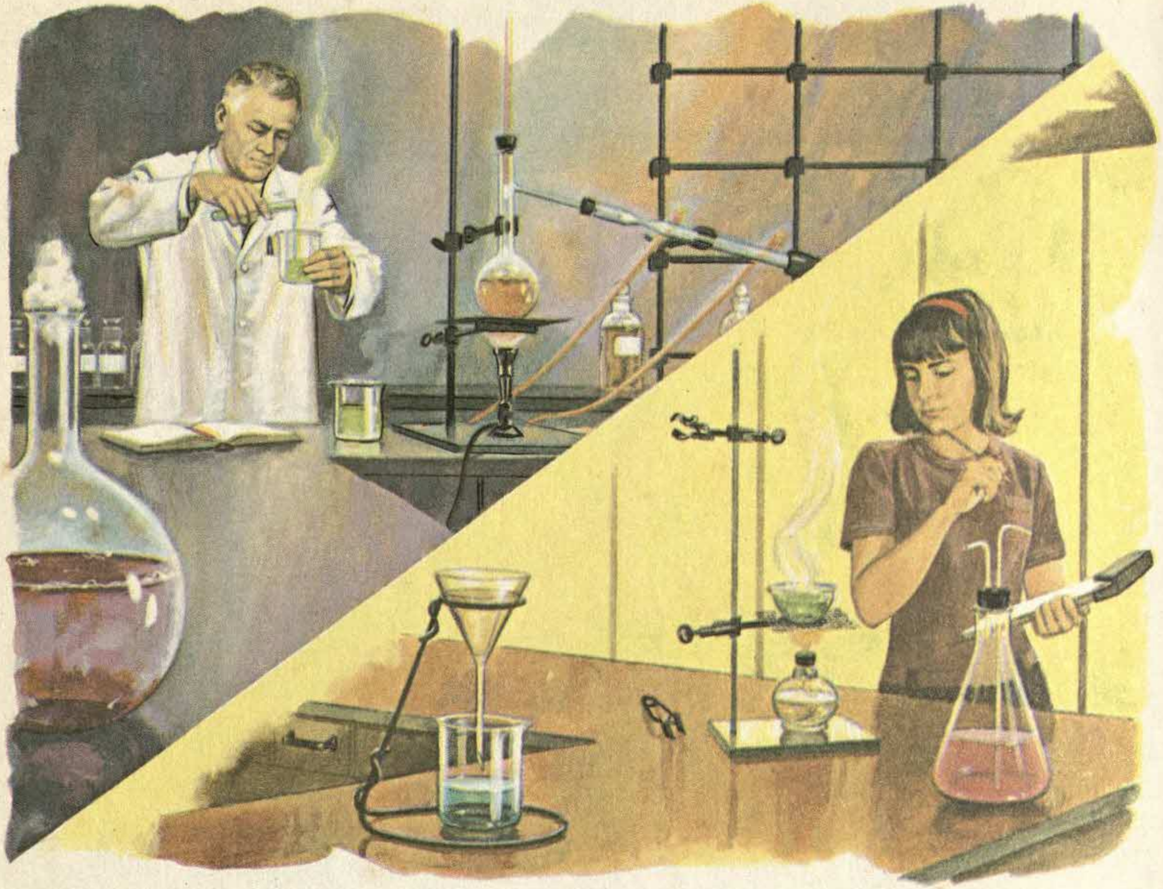


A chemist is never at a loss for problems to solve. Even common materials such as these are challenges. Can they be improved? If so, how? Can any of them be broken up or combined with other substances to make useful new materials?

is being slowly burned up so that we have energy enough to work and play.

Heat brings about some chemical changes. Heat, for instance, helps us get iron away from substances it is joined with in iron ore. Light brings about some chemical changes. Some of these changes make it possible for us to take photographs. Electricity brings about chemical changes, too. One of these changes makes it possible for us to put a thin coat of silver on knives and forks and spoons.

Some chemical changes are very helpful. Others do harm. As soon as a chemist finds out what causes a chemical change, he can plan ways of starting it or preventing it. Chemists have found out, for instance, that when iron rusts the iron joins with oxygen in the air to form iron rust. They have found, too, that iron does not rust unless



there is some water present. Knowing what causes iron to rust has let chemists work out ways of keeping iron from rusting. One way is to keep the iron dry. Another way is to paint it so that the iron and the air do not come together.

Knowing what things are made of helps chemists make new materials—new plastics, for instance. It also helps them find new ways to make materials they already know about. Suppose, for example, a drug is found that cures a certain disease. Suppose, too, that this drug comes from a rare plant that is very hard to get. Chemists now come into the picture. They tear the drug apart to see what it is made of. Then they try to make it from materials they can get easily. Usually they succeed.

Chemists these days are carrying on so many experiments that there cannot be a really up-to-date list of all they accomplish. Space exploration has raised many new problems for them to solve. Among the new materials that have recently been worked out in chemists' laboratories is a paint that can stand the terrific heat a space capsule meets when it falls back to earth through the air.

Once all the chemists were in schools and colleges. Now many of the big manufacturing companies have chemists working for them.

Chemists need a great deal of equipment for their experiments. Some of the apparatus they use they can thank the medieval alchemists for. But much of it is very modern. A chemist may need some completely new piece of apparatus—something no one has ever used before—and he may have to make it for himself. A chemist's equipment is sure to include ways of weighing and measuring very accurately. He may, for example, have a pair of scales sensitive enough to weigh a tiny hair.

Boys and girls learn in science classes and in working with chemistry sets at home to use some of the simpler kinds of apparatus chemists use. The girl in the picture, for instance, is using these pieces of apparatus: a funnel, a funnel support, a beaker, a ring and ring stand, a clamp, an evaporating dish, an alcohol lamp, a flask, a two-holed rubber stopper, a fire screen, and two delivery tubes. Can you find them all? (See ACIDS AND BASES; ALCHEMY; ATOMS; COAL TAR; COMPOUNDS; ELEMENTS; MOLECULES; PLASTICS.)

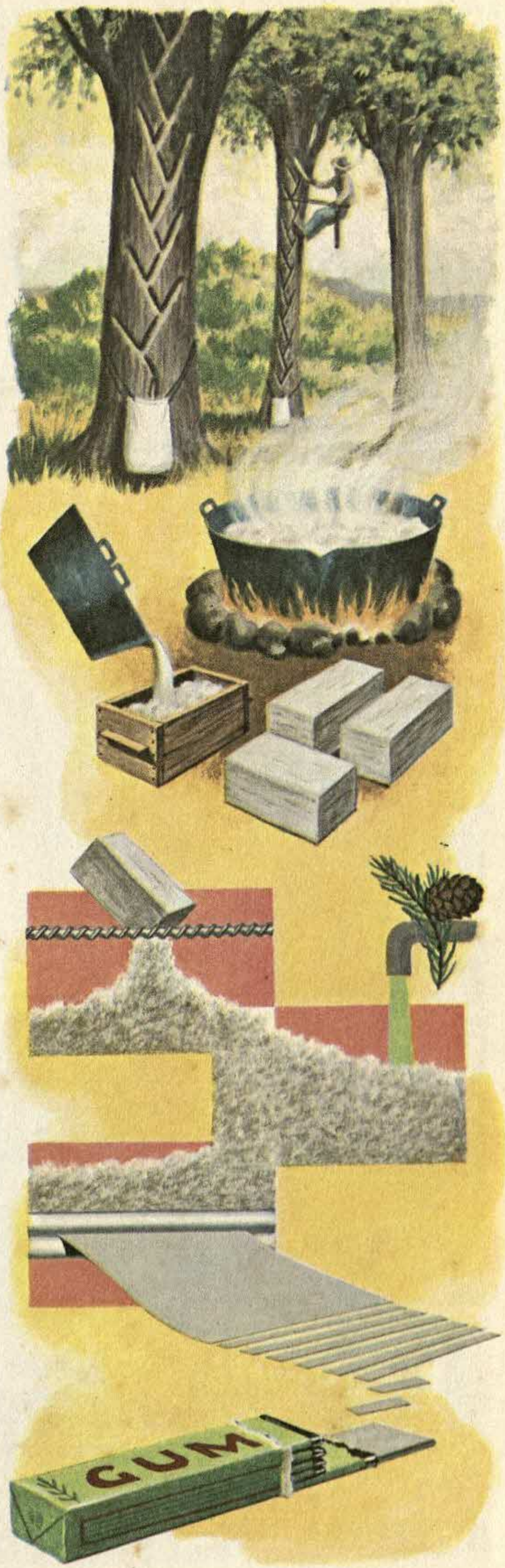
CHEWING GUM Long ago people in different parts of the world discovered that some trees produce a gum which can be chewed and chewed without disappearing. But chewing gum as we know it was first made in the United States.

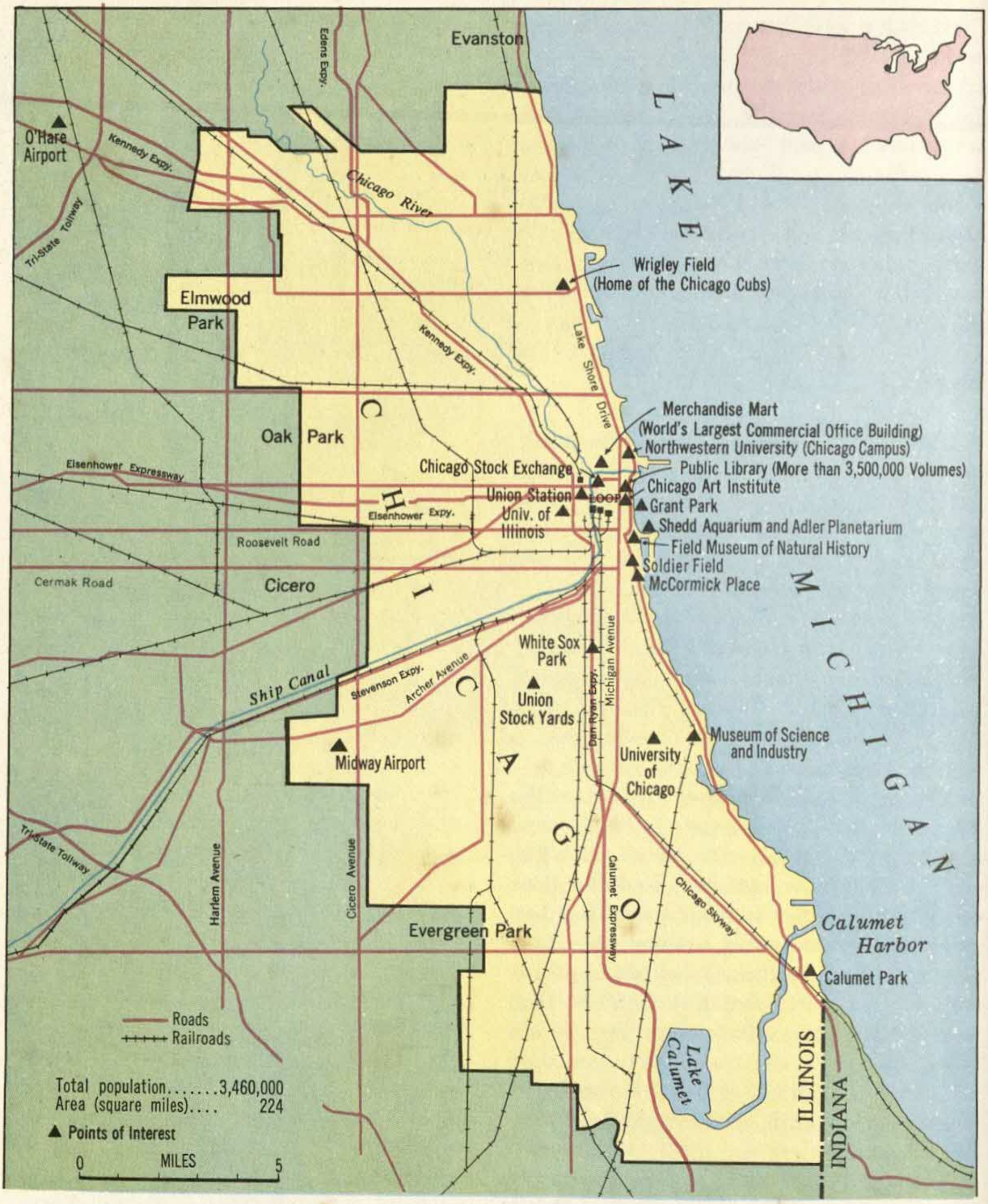
At first the gum from black spruce trees was used. It was purified and sweetened. Later the gum from various other trees was tried, and a cheap chewing gum was made from paraffin. Today most chewing gum is made from chicle and similar substances.

Chicle is the milky juice, or latex, of the sapodilla, a tree that grows in Mexico and northern Central America. Juices much like it from other trees come from South America and the East Indies. In making chewing gum several different latexes, or gums, are mixed together. Some of them are artificial preparations made in laboratories rather than natural gums taken from trees. Sugar, corn syrup, and flavorings are added to the blend of gums. The finished product is about one-fifth gum, one-fifth corn syrup, and three-fifths sugar.

Since it is not eaten up but is simply chewed, many people do not think of chewing gum as food. But, because of the sugar in it, it is. There are nine calories or so in each stick.

The people of the United States spend millions of dollars a year for chewing gum. Big fortunes have been made by some of its manufacturers.




Evanston
Edens Expy.
L A K E
O'Hare Airport
Kennedy Expy.
Chicago River
Tri-State Tollway
Wrigley Field (Home of the Chicago Cubs)
Elmwood Park
Kennedy Expy.
Lake Shore Drive
Merchandise Mart (World's Largest Commercial Office Building)
Northwestern University (Chicago Campus)
Public Library (More than 3,500,000 Volumes)
Chicago Art Institute
Grant Park
Shedd Aquarium and Adler Planetarium
Field Museum of Natural History
Soldier Field
McCormick Place
Oak Park
C H I C A G O
Eisenhower Expressway
Chicago Stock Exchange
Union Station
LOOP
Eisenhower Expy.
Univ. of Illinois
Roosevelt Road
Cermak Road
Cicero
M I C H I G A N
White Sox Park
Michigan Avenue
Dan Ryan Expy.
Union Stock Yards
Ship Canal
Stevenson Expy.
Archer Avenue
Midway Airport
Museum of Science and Industry
University of Chicago
Tri-State Tollway
Harlem Avenue
Cicero Avenue
Calumet Expressway
Chicago Skyway
Evergreen Park
Calumet Harbor
Calumet Park
Lake Calumet
ILLINOIS
INDIANA
Roads
Railroads
Total population.......3,460,000
Area (square miles).... 224
Points of Interest
0 MILES 5

CHICAGO The story of Chicago begins in 1830. In that year the little village of Chicago was laid out around Fort Dearborn, a small fort near the southern end of Lake Michigan. Now this small village has become one of the world's truly big cities. It is the second largest city in the United States. Only New York is larger.

Chicago is about half as big as New York, but New York is 200 years older. It is not quite half as big as London, but London has had 2,000 years to grow in. Railroads, steel, and meat help tell the story of Chicago's rapid growth.

The shortest land routes from the thickly settled northeastern part of the United States to much of the West pass along the southern end of Lake Michigan. Level land stretches for many miles east, south, and west from Chicago. Building roads and railroads on this level land was fairly easy. By the early 1900's Chicago was the greatest railroad center in the world. It still is.

Coal from the south and east, and iron ore from the iron mines near Lake Superior found an easy meeting place in Chicago. The iron ore could be brought rather cheaply down the lakes in big ore boats. The coal could be brought on the railroads in rather short hauls. Coal and iron are needed for making steel. Huge steel mills grew up in and near Chicago. They grew in size and number until today the region is the largest steel-producing center in the United States.

Chicago is in the great Corn Belt. It is within easy reach by railroad of the Great Plains. Cattle, hogs, and sheep could easily be shipped from Corn Belt farms and Great Plains ranches to the city. No wonder Chicago became the country's leader in meat packing. Later it lost its lead in that industry. With the building of highways and the growth of trucking, stockmen could get their stock to markets in other cities by shorter hauls. But as meat packing declined other industries grew.

With steel at hand and with much level land round about, it is not surprising that many factories, such as those that make farming machinery, were started in Chicago. Some factories were attracted to the city by the big supply of fresh water in the lake. Candy, chemicals, packaged foods, electrical machinery, and paint are a few of its factories' many products.

Chicago had a serious setback in 1871. A great fire burned down a large part of the city. But the fire may have been a help in the end. For the buildings built to take the place of those that were burned were better than the old ones.

There is much in the city to attract visitors from all over the world. These are some of the many things to see: the wonderful Lake Shore Drive; many boulevards and parks; two big zoos; some of the finest museums in the world; the business center, or Loop, with tall skyscrapers, great department stores, and good hotels; several famous universities; the Board of Trade, the world's greatest grain trading center; the world's largest commercial office building (the Merchandise Mart); and miles of beautiful homes.

People, and freight as well, reach the city in many different ways. Chicago is not only the country's railroad center but also its trucking center. Trucks of all kinds come and go night and day with their cargoes. Cars and buses, too, travel the broad expressways that link the city with all parts of the country. The O'Hare International Airport is the busiest in the world. Within the city is the again thriving Midway Airport. The St. Lawrence Seaway lets large oceangoing vessels reach Chicago. A canal-river waterway linking Lake Michigan and the Gulf of Mexico helps make the city an important port.

Chicago is nicknamed the Windy City. There are some days when the city deserves this nickname, but they do not come very often. The lake helps make Chicago's climate a pleasant one much of the time.

CHILE One country of South America stretches for more than 2,600 miles along the Pacific Ocean. This country is Chile. Chile stretches about as far from north to south as big Brazil. But it is a great deal smaller than Brazil because it is very narrow. It is not as much as 250 miles wide anywhere. People often call it South America's "shoestring" country.

Chile is south of the equator. Its northern part, therefore, is its warmest part and its southern part its coolest. In Chile it is summer when it is winter in the United States, and the other way around.

All of Chile lies in what has been called the Pacific's "rim of fire." On its east are the towering Andes, with volcanoes among them. And to the west not far offshore is the Atacama Trench, a gash in the floor of the sea more than 25,000 feet deep. It is not surprising that earthquakes and volcanic eruptions are all too frequent in this long coastal land.

About three-fourths of the Chileans live in a great north-south valley in the central part of the country. Valparaiso is the gateway to this valley from the sea. The city's name means "vale of paradise." The central valley *is* a beautiful region. Its climate is like the climate of California. Much of the land is in well-kept farms. There are wheat fields, vineyards, fruit and olive orchards, and sheep and cattle pastures. Chilean farmers drive their herds up into the Andes in summer to let them feed in the rich mountain pasturelands.

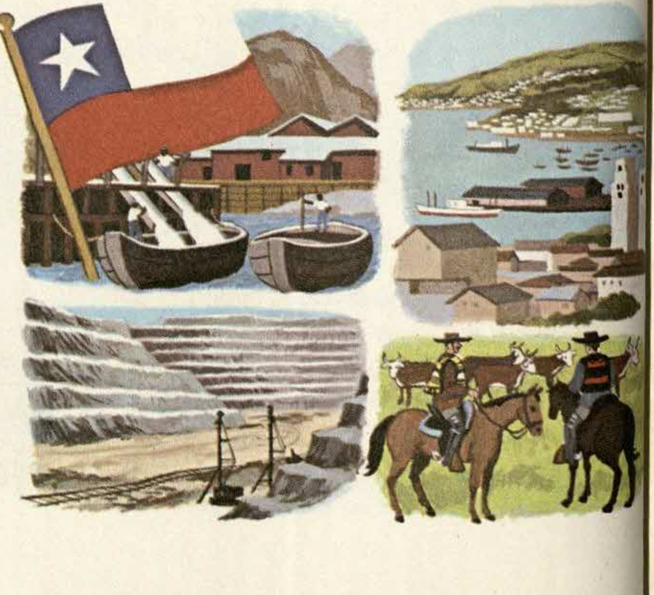
Santiago, the capital of Chile, is in the central valley. It is the fourth largest city of South America. No capital in the world has more beautiful surroundings.

The central valley is Chile's industrial as well as agricultural center. There are furniture, shoe, glass, and textile factories, and chemical plants. Near Concepción there is a big iron and steel mill.

A great deal of Chile is not at all like the central valley. In the highland north of the central valley there is a vast desert. It is by no means a paradise. In places in this desert, years go by without a drop of rain. Visitors talk about the naked ground there. Not even the stoutest cactus plants can grow in that dry soil.

But, strangely enough, much of Chile's wealth is in this desert. For here there are great beds of rock that contain nitrate of soda. Nitrate of soda is an important kind of fertilizer. Every year Chile sells millions of dollars' worth of this fertilizer to other lands. Besides, in the production of nitrate of soda, iodine also is produced. Three-fourths of all the iodine used in the world comes from Chile.

In Chile's northern desert there are also great copper mines. The copper deposit there is one of the four richest deposits of



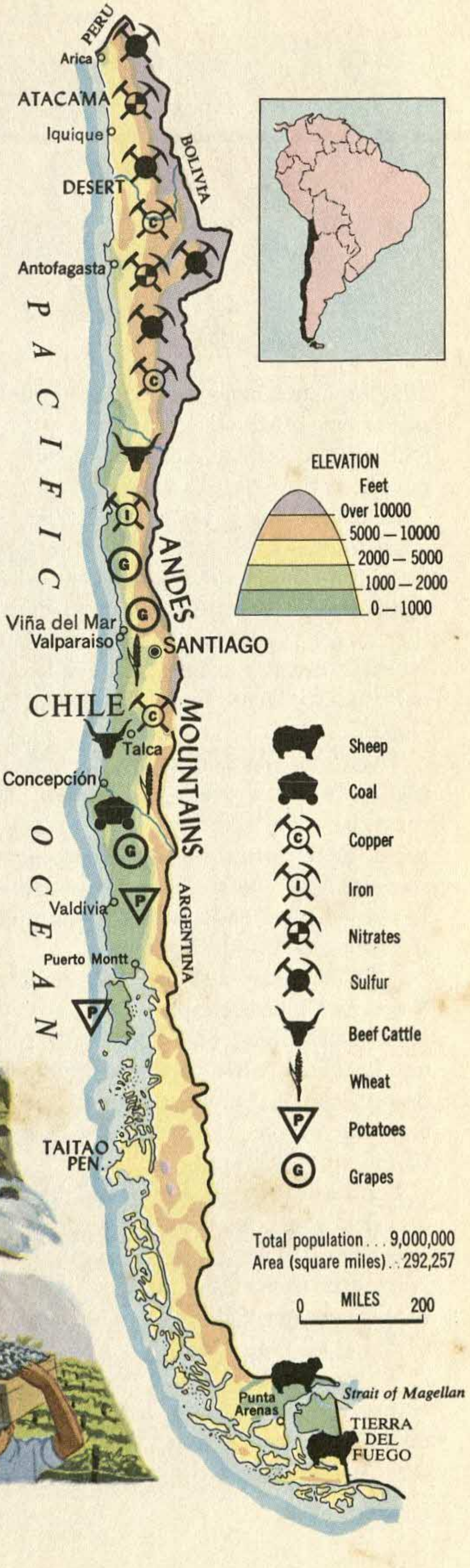
copper in the whole world. Chile's copper is worth even more than its nitrate. There are deposits of iron and borax and salt in the desert region, too.

South of the great central valley the mountains come close to the coast. This part of Chile is cool and rainy. It is a land of forests and sheep ranches. Far to the south, on the Strait of Magellan, is the city of Punta Arenas. Except for small Ushuaia in Argentina, it is farther south than any other city in the world.

In spite of its farms, ranches, forests, mines, and factories, Chile is hard pressed to provide for its growing population. The country has one of the highest birthrates of any nation.

Chile has much to attract visitors from other lands. There is beautiful scenery and there are fine resorts and hotels. The country is famous for its wines and food. There are many fiestas and rodeos. Chilean cowboys, with their broad-brimmed hats and colorful ponchos, make the rodeos worth coming miles to see. They are among the most skillful of horsemen.

About two of every hundred Chileans are pure Indian. Most of the people are white—Spanish or German or English or Italian in the main. The others are part Indian and part white. Spanish is the language of the land. (See ANDES; SOUTH AMERICA.)



Great Wall of China

CHINA The Chinese outnumber the people of any other country. There are about 825 million Chinese. One out of every four people in the world is Chinese.

In size, China is as big as all Europe. It is in southeastern Asia. It stretches westward from the Pacific Ocean for more than 2,000 miles. Its northernmost town is farther north than Quebec, Canada. But its southern coast is as far south as Cuba. The only country larger than China is the Soviet Union.

The Chinese were among the early peoples to build a great civilization. Three thousand years ago they were already irrigating little farms, raising silkworms, and weaving silk cloth. They were traveling in two-wheeled carts, writing with picture-like signs, and building cities.

By 2,000 years ago they had established the early Chinese Empire. The Great Wall, 1,500 miles long, had been built to shut out invading tribes from the north. Great deserts and mountain ranges to the west, and the Pacific Ocean to the east gave China other protection.

Distances between China and other early civilized countries were great. So it is not surprising that until recent times the Chinese knew little about other peoples. Long before those times, the Chinese had invented ways of living all their own.

Writing with a brush and eating with chopsticks are Chinese customs that seem odd to Western peoples. But some things the Chinese invented are now used everywhere. Printing is one of them. Paper is another. Today beautiful things the Chinese have made of silk, paper, procelain, bronze, jade, and the like are sold in shops in many lands. And in China there now are airports, railroads, and modern factories besides the many ancient pagodas, bridges, and palaces from China's past.

Most of the people in China live in the southeastern part of that huge country. Few of them live in western China. The west is a land of plateaus and mountains. And it gets little rain. Eastern China has fewer mountains and more rain. The northern, cooler part of it we call Manchuria. It has many more people than there are in the west. More than two million live in its largest city, Shenyang, or Mukden.

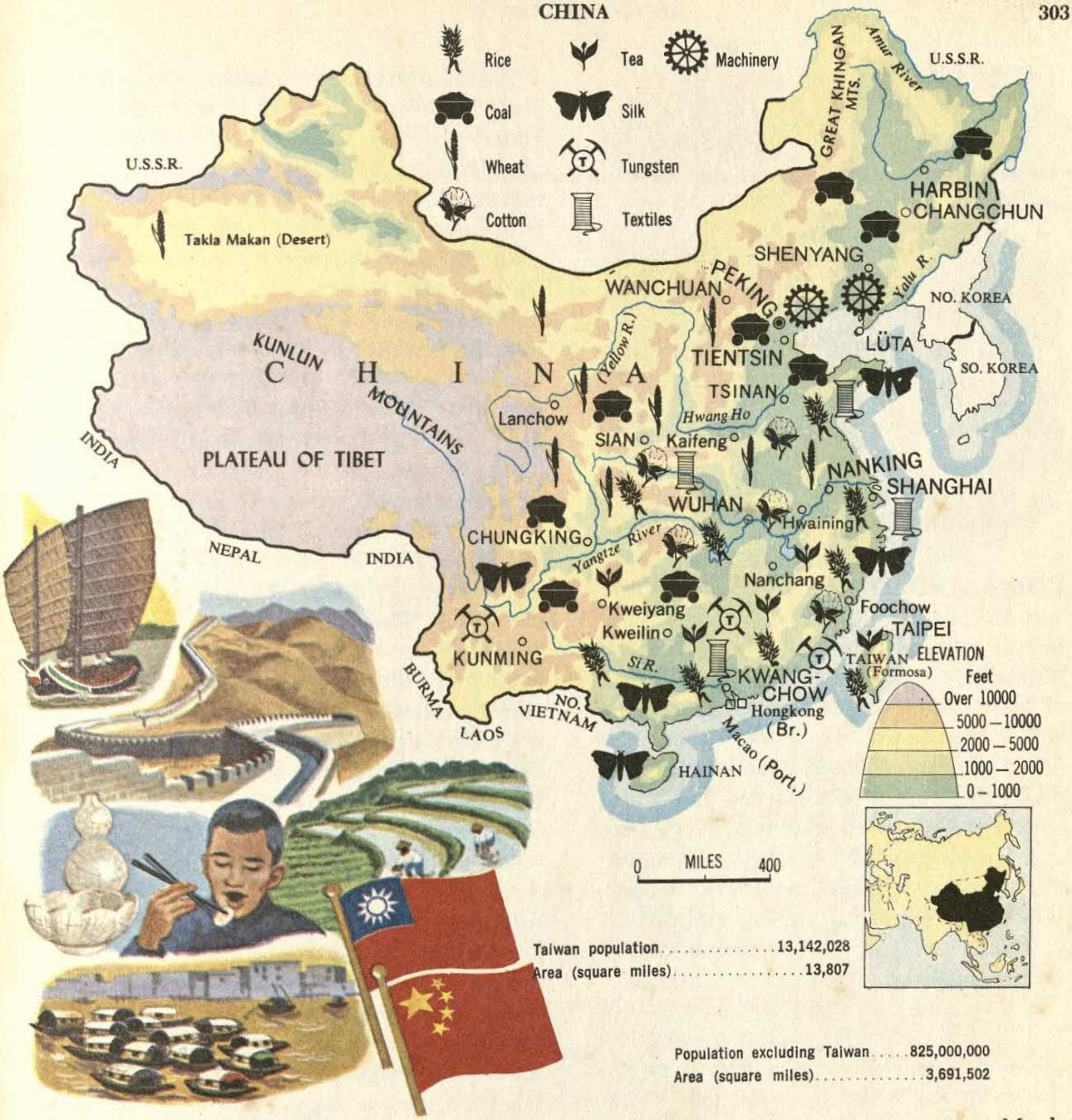
Almost a fifth of the world's people live in southeastern China. Millions of them are in its many big cities. Three cities have more than four million people each, and several others have more than a million. Even so, most people of southeastern China live in its thousands of villages.

China has great mineral riches. Among them are coal and iron. But it often is said that its greatest riches are the Hwang Ho, or Yellow River, and the Yangtze and Si rivers and the farmland in and near their valleys and deltas.

In spite of those rich farmlands, China's farmers over the centuries have been poor. It is very hard to make even a bare living from a farm of only two or three acres.

The chief crop in the southern half of southeastern China is rice. It is raised in fields that can be flooded. The rice fields lie on the valley floors and climb the hills on stairways of terraces built by the farmers. Winters are warm, and two crops of rice are grown each year.

Farther north, between the Yangtze River and the Hwang Ho, the land is less hilly. Winters are not warm. From the air the huge plain crossed by the Hwang Ho looks like an immense carpet of fields of wheat, millet, and cotton. Dark-green dots in the



Taiwan population 13,142,028
Area (square miles) 13,807

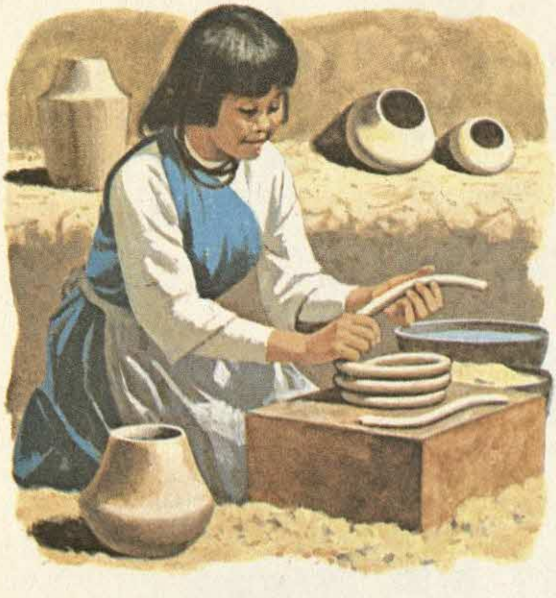
Population excluding Taiwan 825,000,000
Area (square miles) 3,691,502

carpet are clusters of trees in the mud-walled farm villages. In Manchuria the winters are very cold. The chief crops are spring wheat, millet, and soybeans.

Fish is an important food for many of China's millions. The coastal waters, lakes, and streams are rich in fish.

Today the government in control of all the mainland of China has brought about a big change in farming. In 1912 the Chinese overthrew their ruling family, the Manchus, and set up a new government, a republic. Chinese Communists got control in 1949 and set up a Communist government. Much land formerly owned by wealthy landlords was taken over and distributed among the people. Now the many thousands of small farms are organized into groups called communes. The communes manage the farms and pay the farmers wages.

A rival government, the Nationalists, moved to the island of Taiwan, or Formosa, when the Communists took over. China, therefore, has two governments. What their future will be is a question. (See HWANG HO; MARCO POLO; SHANGHAI.)



CHINA AND POTTERY A person can cup his hands and dip up water from a stream to drink. But he must go to the stream to get a drink in this way. A piece of meat can be roasted on a stick over a bonfire. But most vegetables cannot be cooked on a stick. Apples can be stored by piling them up in some corner. But honey cannot be stored in that way. Very long ago our ancestors felt the need of containers for water and food. And very long ago they found that it was possible to form wet clay into useful bowls and jars of various shapes and sizes.

We still use clay for making bowls and jars used in cooking and storing food. We use it for plates and cups and saucers. We use it for vases and beautiful figures. All these things made of clay are called pottery or china. China is really just a special kind of pottery. It is rather glassy, and it is made in such a way that some light can shine through it. It got its name because the Chinese first found out how to make it. Not until hundreds of years later did Europeans learn to make china. Another name for china is porcelain.

The first clay vessels were dried in the sun. Then people found that clay vessels baked in a fire were much better. In time they learned to put on a waterproof glaze.

The discovery of how to make pottery was made many times in many different places. Pottery has been found in the ruins of ancient villages in many different parts of the world. Of course, most of this pottery is broken. But even so it tells scientists a great deal about the people who lived where the ruins are.

In the beginning the early potters were interested mostly in making their pottery useful. Then they became interested in making it beautiful, too. Twenty-five hundred years ago the Greeks made vases as lovely as any that have ever been made.

Making a piece of fine china or pottery is not at all simple. Good clay for pottery making must be found. Then there are five steps: mixing, shaping, firing, glazing, and decorating. The last three steps do not always come in the same order.

Mixing is always the first step. The clay must be mixed with water. Other materials are added, too. For a special kind of china called bone china, for instance, powdered bone called bone ash is mixed with the clay and water. The mixture may be thin enough to be poured. It may be as thick as bread dough.

Shaping is always the second step. In the earliest days of pottery all of it was shaped by hand. The picture on this page shows one of the ways people through the ages have shaped pottery. But for several thousand years people have had the potter's wheel to use for shaping pottery. Wheel-made pottery dating back more than 4,500 years has been found in the ruins of ancient cities in the Near East.

A potter's wheel lets the potter turn the clay round and round as he shapes it. He presses his thumbs and fingers into the clay in just the right places to push it into the shape he wants.

Another way to shape pottery is to use a mold. Much of the pottery of today is made with molds.

Firing means baking in an oven, or kiln. A piece of pottery is fired as soon as it is shaped. It is fired at least once more and perhaps several times. The last firing is always the last step.

A glaze is a substance that hardens into a thin layer of glass. It can be given beautiful colors. Pottery must be fired after it has been coated with a glaze. It may be given more than one layer of glaze.

There are several ways of decorating pottery. A design may be pressed into the soft clay before the first firing. It may be put on by adding extra clay before the first firing. It may be painted on before glazing. It may be painted on after the first glazing. The only decoration on a piece of pottery may be the glaze itself.

None of these ways of decorating pottery is new. Pottery with painted designs was being made even before the use of the potter's wheel. Later, in ancient Athens, vessels of all shapes and sizes were decorated with beautiful paintings. Some showed Greek gods and heroes. Others showed scenes from everyday life. Both the potters and the painters were proud of their work and often signed the pieces.

Potter's Wheel

Most of the pictures here show pottery of long ago. Much beautiful pottery is being made today, too. Many places in the world, among them Dresden in Germany and Copenhagen in Denmark, are famous for their pottery. (See ARTS; HOBBIES.)

CHINCHILLA The chinchilla is one of the rodents—the gnawing mammals. It is therefore a cousin of the rats, mice, squirrels, and chipmunks. Its home is in the mountains of South America.

There are not many wild chinchillas left. Most of them have been killed for their beautiful fur, which is pearly gray and very thick and soft. Chinchillas are now raised on farms just as mink and foxes are.

Wild chinchillas are shy little creatures. After spending the daytime in their holes among the rocks, they come out at dusk. If anything frightens them they pop back into their holes to wait for the danger to pass.

Like other rodents, chinchillas are plant eaters. Their food is mainly grasses, grains, fruits, and roots. Occasionally they catch insects. When they have found something to eat they hold it in their front paws and nibble it just as squirrels and chipmunks do. (See FURS; RODENTS.)

CHLORINE Back in 1774 a Swedish scientist heated a mixture of chemicals. Out of the mixture bubbled a greenish-yellow gas that had a suffocating odor. The scientist, Karl Wilhelm Scheele, thought he had made a new gas containing oxygen. Years later another scientist, Sir Humphry Davy, proved that Scheele had discovered a new element. He named it chlorine.

In nature chlorine is always joined with at least one other element. It is, we say, always in a compound. Salt is a compound made of chlorine and sodium.

Although chlorine is a gas, it can be changed to a liquid. Great amounts of it are sold in liquid form.

Chlorine is poisonous to breathe. In World War I it was used as a poison gas. Fortunately, it is poisonous to germs, too. Small amounts of it are dissolved in the water of swimming pools to kill germs. Large cities use it to purify their drinking water, too.

Chlorine is also used for bleaching. It is very important in whitening cottons, other textiles, and paper.

From their names it is easy to guess that carbon tetrachloride and chloroform have chlorine in them. Carbon tetrachloride can be used to put out fires. It is also a good cleaning fluid. Chloroform is used as an anesthetic. Other compounds of chlorine are helpful as weed killers and moth repellents. Still others go into plastics, synthetic rubber, and the cooling material in mechanical refrigerators.

CHOCOLATE AND COCOA Both chocolate and cocoa are made from the seeds of the cocoa tree. The scientific name of this tree is *Theobroma cacao*. "Theobroma" means "food for the gods." The famous Swedish botanist Linnaeus named the tree after tasting chocolate for the first time. Many people today like chocolate and cocoa so much that they would agree that the name is a good one.

Cocoa trees can be raised only near the equator. They need much warmth. The trees are about 20 feet tall. They have long, leathery leaves and small pink blossoms. Many of the thousands of blossoms fall off, but some stay on and grow into seedpods. Usually there are about 25 pods on a tree. A pod may be over 12 inches long and have 50 seeds in it.

When the seedpods are ripe, they are cut from the tree. The pods are cut open and the seeds and pulp scooped out and put in piles or "sweating boxes" to ferment. Several days later the beans are separated from the fermented pulp and dried. Then they are bagged and shipped to factories. There the beans are cleaned and roasted. After roasting, the thin skins of the beans are cracked off and blown away. The kernels, or "nibs," are left. Chocolate is made by grinding the nibs between rollers. Sometimes sugar is added. For cocoa, much of the fat in the chocolate is removed. This fat, or cocoa butter, is used in candy and soaps and as an ointment.

The pulp and seeds are removed from the pod.

When the Spanish explorer Cortés came to Mexico, he found the Aztecs using a drink they called chocolate. It was highly spiced, partly with pepper. Cortés and his men learned to drink it. In Spain the drink was made better tasting by adding sugar instead of pepper. By 1600 "chocolate" had spread to other parts of Europe. A hundred years later the English made it into a very good drink by adding milk.

Today a million tons of chocolate and cocoa are used each year. Not only drinks but also candies, cakes, puddings, and pies are flavored with it.

The cocoa tree is an American plant. It still grows wild in the northern part of South America. It was cultivated from Mexico to Ecuador when the New World was discovered. Later other tropical countries began growing it. Today much of the world's supply comes from Africa.

CHRISTMAS For the Christian world the 25th of December is one of the happiest holidays. It is the day celebrated as the birthday of Jesus. We call it Christmas.

So far as we know, Christmas was first celebrated in Rome some 16 centuries ago. For many years His birth was celebrated on a different day in the eastern part of the Roman Empire. But in time most of the Christian world took December 25 as Christmas, the day of the Nativity.

The name Christmas is short for "Christ's Mass." A Mass is a church service. Christmas is a religious festival. There are special Christmas services in Christian churches all over the world. But many of the festivities of Christmas do not have anything to do with religion.

The idea of Christmas gifts may have come from the story of the three Wise Men. In some countries Christmas presents are not given until January 6, or Twelfth Night, supposedly the time when the Wise Men brought gifts to the baby Jesus. But many people think that the idea of Christmas gifts came from an old Roman custom. December 21 is the shortest day of the year. Right after that time in the northern hemisphere days begin getting longer. The people of long ago were very happy when the days began getting longer. They thought of the return of longer days as the birthday of the sun. Christmas comes on the same day the Romans were exchanging gifts to celebrate the lengthening of day.

Decorating with holly, mistletoe, and evergreens goes back to an early custom in northern Europe. The people there used the decorations we now call Christmas greens to celebrate the time when days grow longer. Today in America the poinsettia is much used for Christmas decorations.

Burning a great Yule log is another custom that grew up in northern Europe as a part of the midwinter celebration. Bringing in the Yule log was a joyous ceremony in old England. The Yule log is still important in many places.

The idea of Christmas trees came from Germany. Now it has spread to many other countries throughout the world.

A little manger scene may take the place of a Christmas tree in many lands. The scene shows the baby Jesus cradled in a manger. Mary and Joseph are watching over him. Standing near are several animals—some sheep, perhaps, and a donkey. There may be a shepherd or two. The French people call a scene of this kind a crèche (KRESH).

The name "Santa Claus" comes from "Saint Nicholas." St. Nicholas is considered the special friend of children. Many Dutch children still hang stockings or put wooden shoes by the fireplace for St. Nicholas to fill the night before his feast day, December 6. In America the idea of a saint changed to the idea of a jolly fat man dressed in red who lives at the North Pole and rides in a sleigh drawn by reindeer. This picture of a jolly Santa Claus came chiefly from a poem written by Clement Clarke Moore in 1825. The poem was "A Visit from St. Nicholas." It is better known by its first line, "'Twas the Night before Christmas."

In many countries groups of carolers going about singing Christmas carols are a part of Christmas. Among the best-known Christmas songs are "Silent Night," "The Holly and the Ivy," "Deck the Halls," "Good King Wenceslaus," and "We Three Kings of Orient Are."

Christmas cards by the millions are sent at Christmastime. Much of the credit for making this custom common is given to Louis Prang. His first Christmas cards, printed in 1875, were a big success.

Over much of the world Christmas falls in the middle of winter. People there like a snowy Christmas. Irving Berlin's "I'm Dreaming of a White Christmas" is heard over and over at holiday time.

South of the equator December comes in summer. Christmas Day may be a hot summer day, and Christmas dinner may be a picnic on the beach.

CHROMIUM Many people know what chromium looks like, for much of the metal trimming on automobiles is plated with chromium. The plating is very thin, but it makes a pretty covering for the steel underneath and keeps it from rusting.

Chromium, however, would not be a very important metal if it were used just to trim automobiles. Really very little of all the chromium used goes for trimmings. Far more goes into stainless steel.

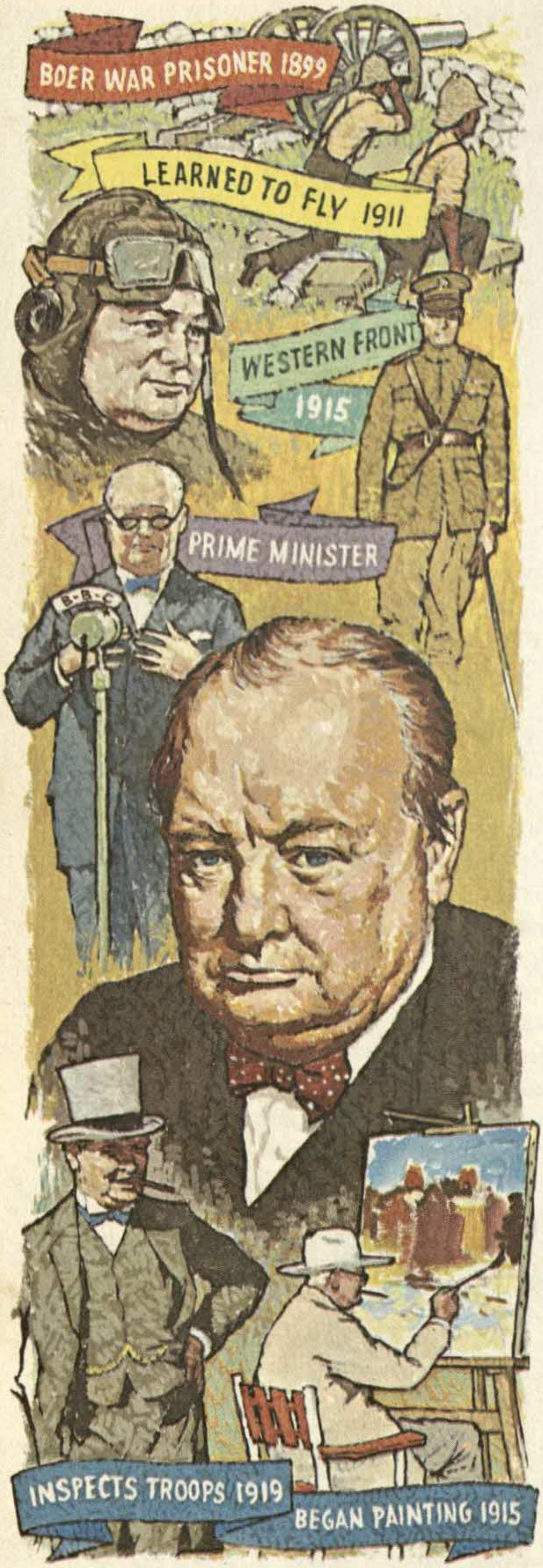
The name "chromium" comes from the Greek word for "color." Chromium gives a beautiful color to many of the substances in which it is found. Rubies and emeralds owe their color to the presence of chromium. The coloring matter, or pigment, in some paints is made from chromium.

Chromium is never found pure. The people of ancient times did not know that there was such a metal.

The ore that supplies the world's chromium needs is called chromite. Chromite is useful as a lining for furnaces for making steel. It can stand temperatures up to nearly 4,000° F. before it melts.

There are stores of chromium ore in the United States, chiefly in Montana, Washington, Oregon, and California. But not a great deal of this ore is being mined. The country gets from other lands most of the two million tons of chromite it needs each year. Among the big producers are Rhodesia, South Africa, Turkey, and the Philippines. (See ELEMENTS; METALS.)

Ores of Chromium



CHURCHILL, SIR WINSTON LEONARD SPENCER (1874–1965) Few people in history have been outstanding in as many fields as Winston Churchill. He won world fame as a war leader, writer, and public speaker.

Churchill's father was English—a descendant of the famous Duke of Marlborough. His mother was an American, Jennie Jerome. When he was 21, Churchill joined the British Army and served for a time in India. In 1899, while working as a newspaper correspondent in the Boer War in Africa, he was captured. He made a daring escape and came home a hero. In 1900 he was elected to Parliament.

During World War I, Churchill held important positions in the British cabinet. In the years following the war his importance grew less. But before World War II began, Churchill again became prominent by warning about the danger from Hitler. When World War II started, Churchill was put in charge of the British Navy. Less than a year later he became prime minister.

It is as prime minister that Churchill is best known. He became the leader of his country in May, 1940. The following month, Italy joined Germany in the war against France and England. Within days France surrendered. Everyone thought England would soon be invaded. Churchill told his people they would have to expect "blood, toil, tears, and sweat." But he promised that Britain would never surrender.

Confidence and courage rang out in every speech Churchill made to his countrymen. The English endured terrific bombings, but they fought back. Churchill did much to give them the will to carry on.

Churchill wrote many books. In 1953 he won the Nobel prize for literature for his six-volume history of World War II.

Millions of people throughout the world mourned Churchill's death in 1965. His funeral procession was a magnificent pageant. But he was buried in a small churchyard near Blenheim Palace, where he was born.

CIRCLE Put a dot on a piece of paper. Draw a line and make it curve so that it is always the same distance from the dot. The line will finally reach the place where it started. On the paper there will be a circle with the dot in the center. An easy way to draw a circle is to use a drawing tool called a compass. Every part of a perfect circle is exactly the same distance from the center. This distance is the radius.

Anyone hunting for circles will find them almost everywhere. The outer edge of a coin is a circle. So is the rim of the full moon as we see it in the sky. Rings, bracelets, wheels, polka dots, and many plates, saucers, and clock faces are circular, too. You can easily find others.

The equator is an imaginary circle around the earth halfway between the South Pole and the North Pole. The center of this circle is deep inside the earth. The path of the earth around the sun is almost a circle.

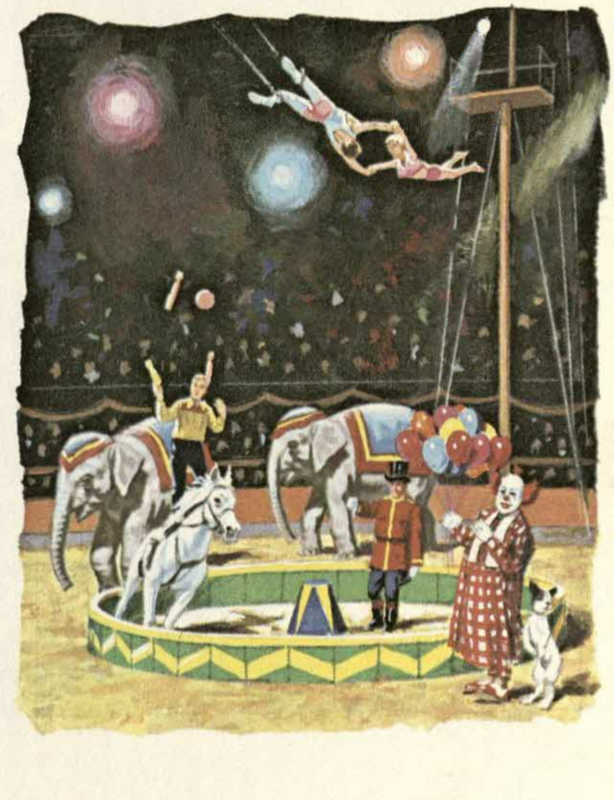
The easiest way of telling how big a circle is, is to tell its diameter. The diameter of a circle is the distance across it through its center. The diameter of the equator is nearly 8,000 miles. It is over 500,000,000 times as great as the diameter of the circle the compass in the picture above has just drawn.

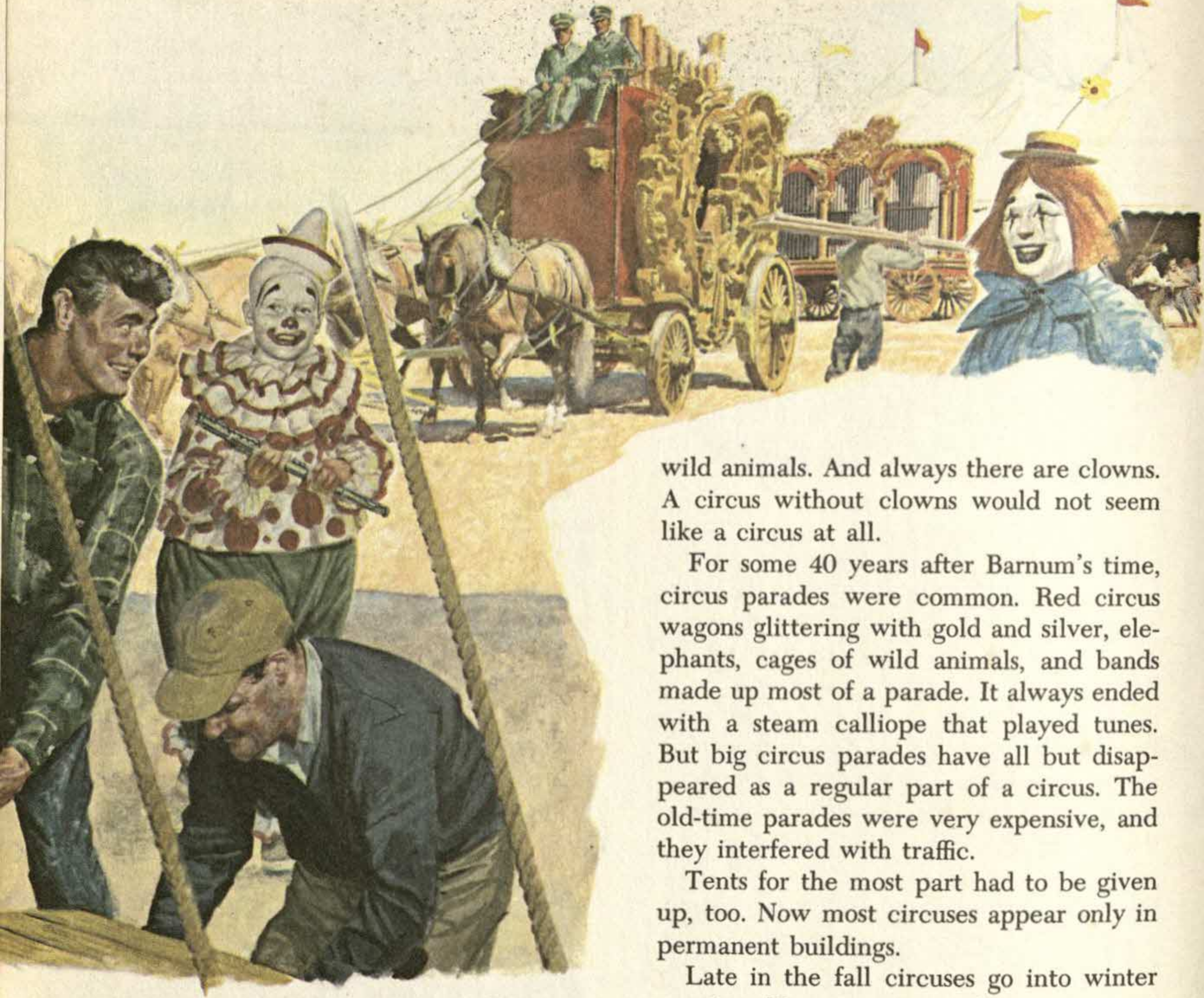
CIRCUS "The circus is coming to town" was for many years news boys and girls all over the United States looked forward to each summer. Perhaps the circus to come was a small one. Perhaps it was "The Greatest Show on Earth." No matter how big it was, it was sure to be fun. And circuses, although they are not nearly as common in this country as they once were, are still great fun.

The word "circus" is much like the word "circle." There is a good reason why. Every circus has one or more circles, or rings, where the performances go on. A big circus usually has three rings.

The first circus we know anything about was in ancient Rome. The Roman circus was made up mostly of chariot races. After the fall of Rome there were no circuses for centuries. Then, about 200 years ago, small circuses began traveling about in England. Many of the performers were acrobats or jugglers.

The first circuses in America were in Philadelphia and New York in George Washington's time. Washington went once. Soon afterward there were circuses in many





places. At first they were in open fields. Then a tent, or "big top," began to be used.

For more than half a century circuses were mostly horseback riding—turning somersaults on horseback, vaulting on and off, and having horses step to music. Gradually other acts came in.

P. T. Barnum did much to make circuses into the great shows they became. He had many new ideas. In a circus today there are acrobats, trapeze performers, bareback riders, and trained animals. There are special stunts high in the air—such stunts as walking a tightrope and riding a bicycle along a high wire. There are sideshows. Usually there is also a menagerie of caged wild animals. And always there are clowns. A circus without clowns would not seem like a circus at all.

For some 40 years after Barnum's time, circus parades were common. Red circus wagons glittering with gold and silver, elephants, cages of wild animals, and bands made up most of a parade. It always ended with a steam calliope that played tunes. But big circus parades have all but disappeared as a regular part of a circus. The old-time parades were very expensive, and they interfered with traffic.

Tents for the most part had to be given up, too. Now most circuses appear only in permanent buildings.

Late in the fall circuses go into winter quarters. New costumes and new acts must be made ready for the new season. For more than 30 years Ringling Brothers had winter quarters in Baraboo, Wis. Then Sarasota, Fla., became their winter home. In each of these cities there is now a circus museum.

Although in this country there are fewer circuses than there used to be, the story is different in Europe. Our television often shows acts from European circuses.

One city is doing a great deal to keep Americans from forgetting the circus days of the past. At Fourth of July time each year Milwaukee has a big festival. As a part of the celebration circus wagons are brought from the Baraboo museum and there is a continuous show of circus acts.

CITIES There were many great cities in ancient times. Thebes, Babylon, Nineveh, Tyre, Damascus, Athens, Carthage, Byzantium, and Rome were a few of them. Their story is an important part of the story of civilization. Some of the cities of ancient times are still cities today. Others have been buried for centuries.

About 1,500 years ago barbarian tribes pushed their way into the great Roman Empire. They brought about its ruin. They burned down most of the cities. City life did not appeal to them. They were used to roaming about from place to place. Europe remained a land of pastures and little villages for many years.

But after a dozen generations or so these barbarians settled down. There came to be great lords who lived in castles. Clusters of huts grew up in the shadow of the castle walls. The people were safer there. Great cathedrals were built, and many people came to live nearby. Castle and cathedral villages slowly grew into cities.

Walled City of Ávila, Spain

The Crusades helped make the cities of Europe grow. The knights who went to fight in the Holy Land saw that their way of living was not the only way. They wanted finer clothes, more comfortable homes, and more interesting foods. They wanted silks and spices and perfumes from the East. Merchants were needed. Bankers were needed, too, to arrange for the buying and selling of goods. The need for merchants and bankers was one reason for the growth of the cities. It was easier for men to do business with one another if their places of business were close together.

Stockholm, the Largest City in Sweden

When European cities began to grow, there were no strong nations to keep law and order. Cities had to protect themselves from bands of robbers. They had to protect themselves, too, from neighboring nobles who wanted to conquer them. Many cities of the Middle Ages had walls around them. An old walled city is the heart of a number of cities of Europe today.

Early in the Middle Ages people raised most of their own food. They made their own clothes. They built their own houses. Then many people began making things to sell to others. They soon found that some things could be made better in factories than at home. The growth of factories helped cities grow.

Cities have not always been pleasant places to live. A person from a city of the Middle Ages would marvel at the smooth pavements, the bright streetlights, and the hidden sewers of today's cities. He would be surprised not to see pigs rooting for garbage in the mud in the streets. He would be surprised, too, at the care cities take to keep diseases from spreading.

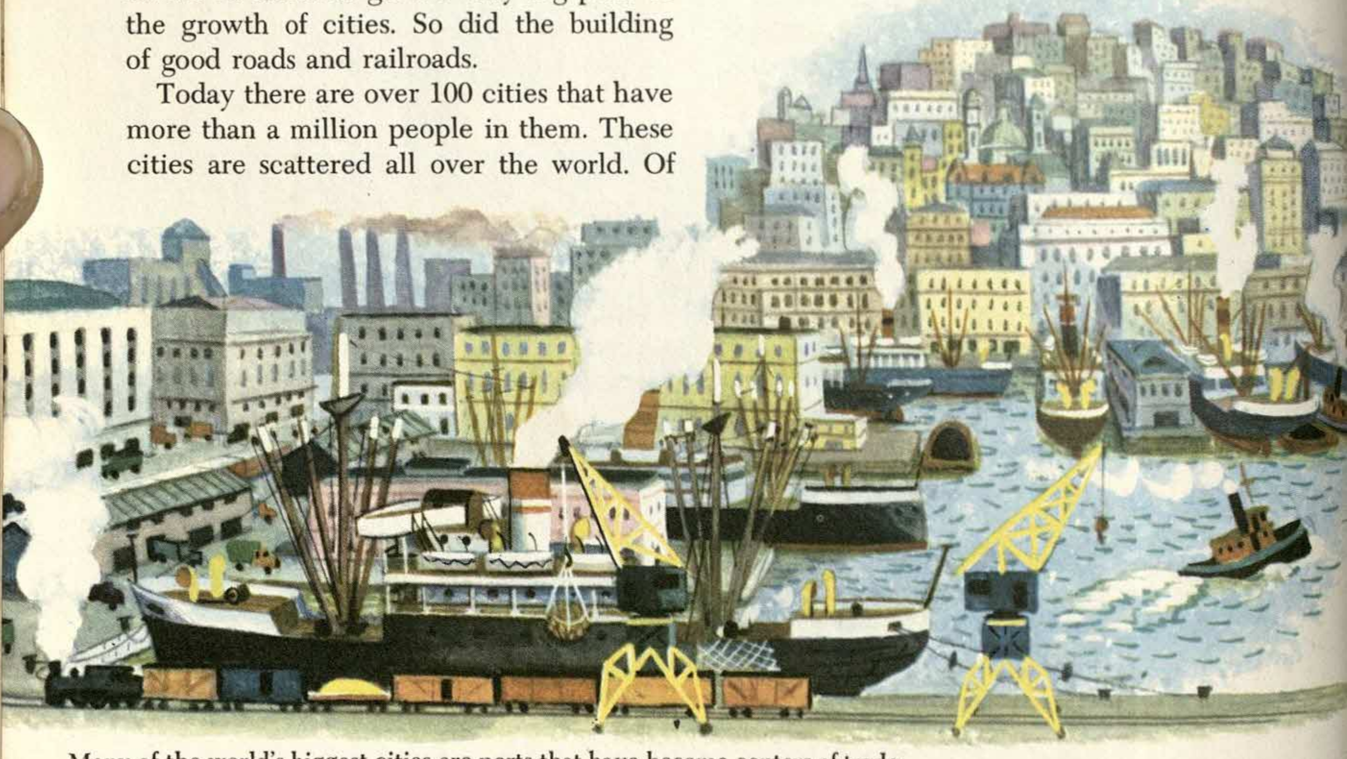
The invention of the steam engine and its use in factories gave a very big push to the growth of cities. So did the building of good roads and railroads.

Today there are over 100 cities that have more than a million people in them. These cities are scattered all over the world. Of all the inhabited continents, Australia has the fewest large cities. Asia, with the world's largest population, has the most.

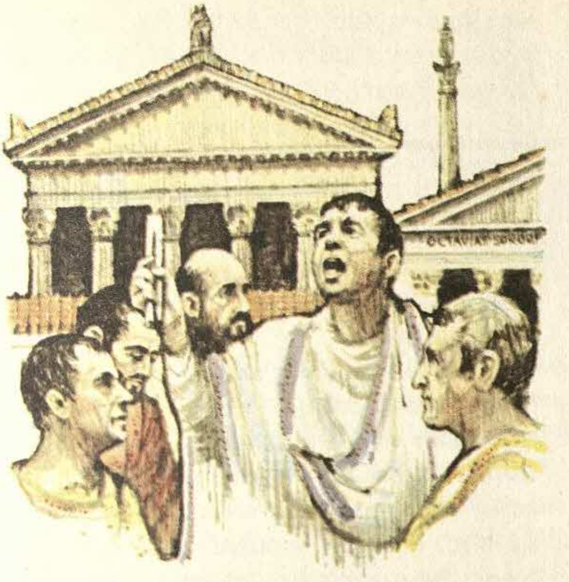
It is not just by chance that big cities have grown up where they are. One city may be at a place where travel by land meets travel by sea. Perhaps another is near a big coalfield or is on a great river. An important part of the story of every city is how it came to be where it is.

The table names ten of the world's very large cities. Around almost every great city there are lesser cities and towns so closely linked to it that for all practical purposes they are part of the city itself. More than half the people of the United States live in such a metropolitan area, or megalopolis. (See URBAN RENEWAL.)

CITY	COUNTRY	POPULATION
Shanghai	China	Over 10,000,000
Tokyo	Japan	Over 8,000,000
London	England	Over 8,000,000
New York	U.S.A.	Over 8,000,000
Peking	China	Over 7,000,000
Moscow	U.S.S.R.	Over 6,000,000
São Paulo	Brazil	Over 5,000,000
Bombay	India	Over 4,000,000
Cairo	U.A.R. (Egypt)	Over 4,000,000
Mexico City	Mexico	Over 3,000,000



Many of the world's biggest cities are ports that have become centers of trade.



CITIZENSHIP *The Man Without a Country*, by Edward Everett Hale, is the story of a man accused of treason. At his trial he said that he hoped he would never hear the name of his country again. The judge gave him his wish. For 55 years he was not allowed to set foot in his country or hear any news of it. He was not a citizen of any country. As he was dying, homesick and friendless, he begged to be taken back to his native land.

Most of us do not realize how important it is to be a citizen of a country. Every country helps its citizens in many ways. Back in the days of ancient Rome, a Roman's proudest boast was, "I am a Roman citizen." A country helps and protects its citizens even when they are in other lands.

Different countries have different ways of deciding who is a citizen. Being born in a country may make a person a citizen of that country. Having parents who are both citizens of the same country may make a child a citizen of that country no matter where he is born. Many citizens of the United States are naturalized citizens. They are immigrants who came from other countries and decided that they wished to become American citizens. The laws of the United States tell the steps a person must take to become naturalized.

Being a citizen of a country does not mean merely getting protection and help from its government. It also means that the citizen has duties to his country. He owes it to his country to obey its laws, to pay the taxes it asks of him, and to fight for it if called on to do so.

If his country is a democracy, a citizen should take part in its government. He should try to find out what his country's problems are. In elections he should vote for those who stand for what he believes. He should do his share in making his country one its citizens can be proud of.

A citizen of the United States is also, as a rule, a citizen of one of the states. His state citizenship gives him both rights and duties.

CITRUS FRUITS All the fruits shown in the picture on the next page come from plants that are close relatives. They are all citrus fruits. They get the name "citrus" from citron, a fruit more common in Mediterranean lands than in America. Citrus fruits have leathery skins, or peels. The pulp is divided into sections.

Oranges are the most popular of the citrus fruits. There are many different kinds. Some kinds are especially good just peeled and eaten as they are. Navel oranges are good eating oranges and are seedless. Some oranges are best for juice. A big part of each year's orange crop goes into frozen orange juice.

An orange grove is beautiful. The trees have shiny leaves and fragrant white blossoms. A tree may have blossoms, green fruit, and ripe golden fruit all at one time.

Grapefruit orchards are beautiful, too. In fact, grapefruit trees would probably be raised for their beauty even if their fruit were not popular. The grapefruit got its name because the fruits grow in bunches like bunches of huge grapes.

Lemons and limes are sourer than oranges. We use their juice. Much of it goes into lemonade and limeade.

Tangerines, or "kid-glove" oranges, are much like small oranges, but they have a milder taste. They are very easy to peel.

Kumquats are the smallest of the citrus fruits. They are eaten skin and all.

Only the peel of the citrons is eaten. It is candied. Most fruitcakes have candied citron peel in them.

Among the less well-known citrus fruits are the shaddock, or pummelo, and the calamondin. Pummelos are like big grapefruit but have very thick skin. Calamondins are like little tangerines.

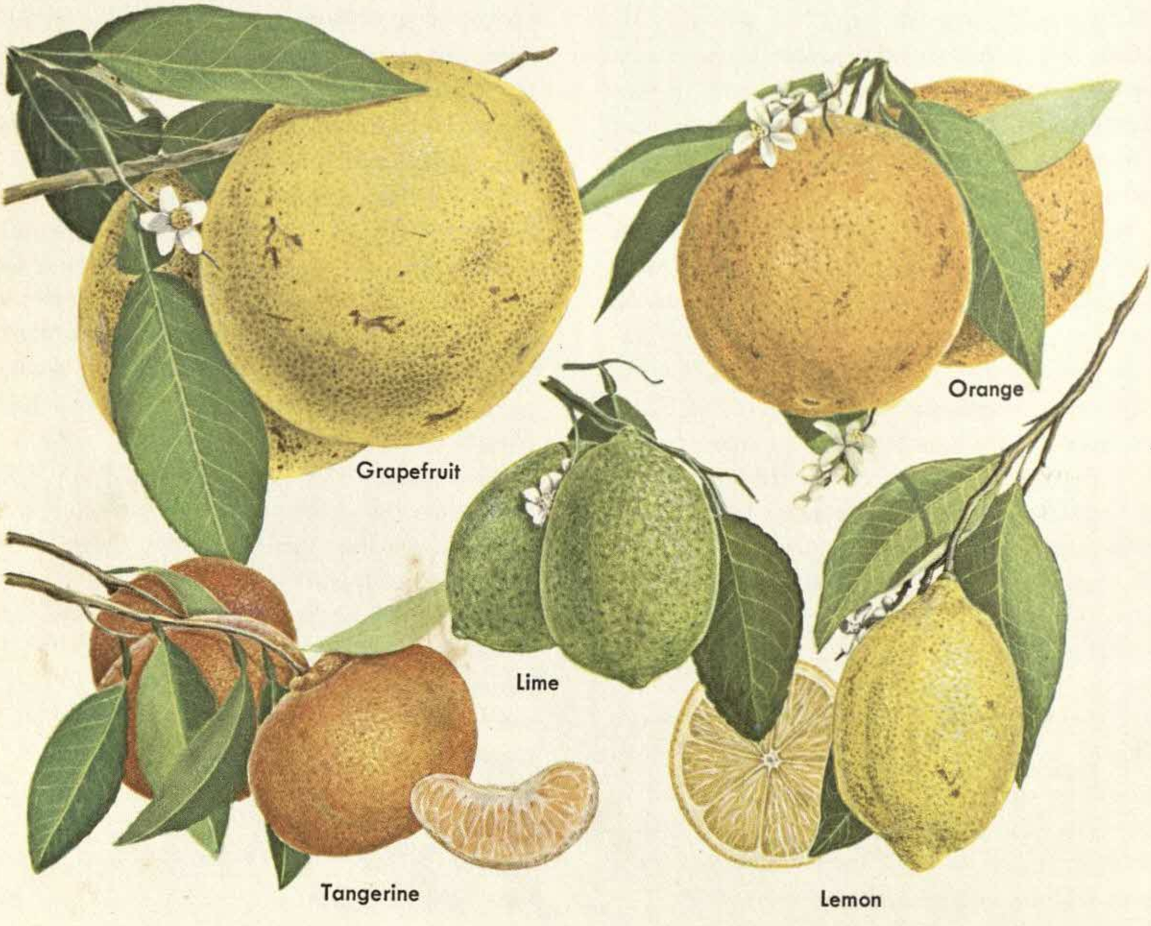
Some citrus fruits are man-made. They are crosses, or hybrids. The tangelo is a cross between the grapefruit and the tangerine. The ortanique is a cross between the tangerine and the orange. Limequats are lime-kumquat crosses.

More than 200 years ago a doctor in the British navy found that the juice of lemons and limes would cure sailors who were sick with scurvy. Scurvy was then a common disease. Soon the British navy was providing lemons and limes for all its sailors. So many limes were used that the sailors were called "limeys."

For a long time no one knew why lemons and limes cure scurvy. Now we know that it is because they contain vitamin C. All citrus fruits do.

There are miles and miles of citrus groves in the United States. They are all in the South and Southwest, for citrus trees cannot stand cold weather. Frost is the worst enemy of the orchards. Sometimes smudge fires are started in an orchard when there is danger of frost. The smoke makes a blanket that protects the trees.

In our markets there are citrus fruits the year round. They keep well and can be shipped easily. (See FRUITS; VITAMINS.)



CIVIL RIGHTS On Aug. 28, 1963, 180,000 black and 30,000 white Americans came together in Washington, D.C., and marched from the Washington Monument to the Lincoln Memorial. There speeches were made calling on the country to give all its people, of whatever race or color, an equal chance of success. This Freedom March did a great deal to make the United States aware of the problems of civil rights.

The Declaration of Independence has the words, "all men are created free and equal." The building of the country was based on that idea. But freedom and equality did not prove to be easy for all to get. Slavery ended a century ago, but by no means all Americans have had equal opportunities. Because of their race or color many have had poor schools, poor places to live, and few chances to get good jobs. They have found many hotels, restaurants, hospitals, and amusement places closed to them. Many have been kept from voting. Rights to be treated equally so far as such things go are called civil rights.

Many groups have been formed to work at correcting the situation. Among them are the NAACP (National Association for the Advancement of Colored People), SCLC (Southern Christian Leadership Conference), CORE (Congress of Racial Equality), and SNCC (Student Nonviolent Coordinating Committee). In 1964 Dr. Martin Luther King, Jr., leader of SCLC, won the Nobel Peace Prize for his work.

Many peaceful demonstrations such as the Freedom March have been carried on in various places. But some people think that changes brought about by peaceful means are too slow. They preach violence instead. Their ideas have led to riots.

Progress has been made. Laws have been passed to help. Public schools, for example, cannot now be segregated—there cannot be separate schools for black children or white children in a school area in which both blacks and whites live. Employers cannot refuse a job to a person because of his color or race. In many places it is against the law to refuse to sell or rent a home to a person because of color or race. Many government programs are under way to give children a better chance.

Many private groups are helping. Some companies make a point of offering jobs to the underprivileged. Many private schools hunt for promising students and give them scholarships. And there are many private groups working in crowded city ghettos.

To see that changes have come about, we need only think, as we look at today's major league baseball teams, that in 1947 it was startling news that the Brooklyn Dodgers had hired a Negro player, Jackie Robinson. The fact that there are now cities with Negro mayors is another sign of progress.

Many people have the wrong idea that civil rights concern only blacks. There are other groups—the American Indian for one —that have not had many opportunities.

Civil rights is not, moreover, just a United States problem. It is worldwide. And it will never be fully solved until people overcome their prejudices and feel toward those of other races and colors as they feel toward those of their own.

Coquina Shells and Giant Clam

CLAMS Thousands of animals without backbones have shells. Clams are among them. The shells of clams are always in two parts, or valves. The two valves are held together by a strong hinge.

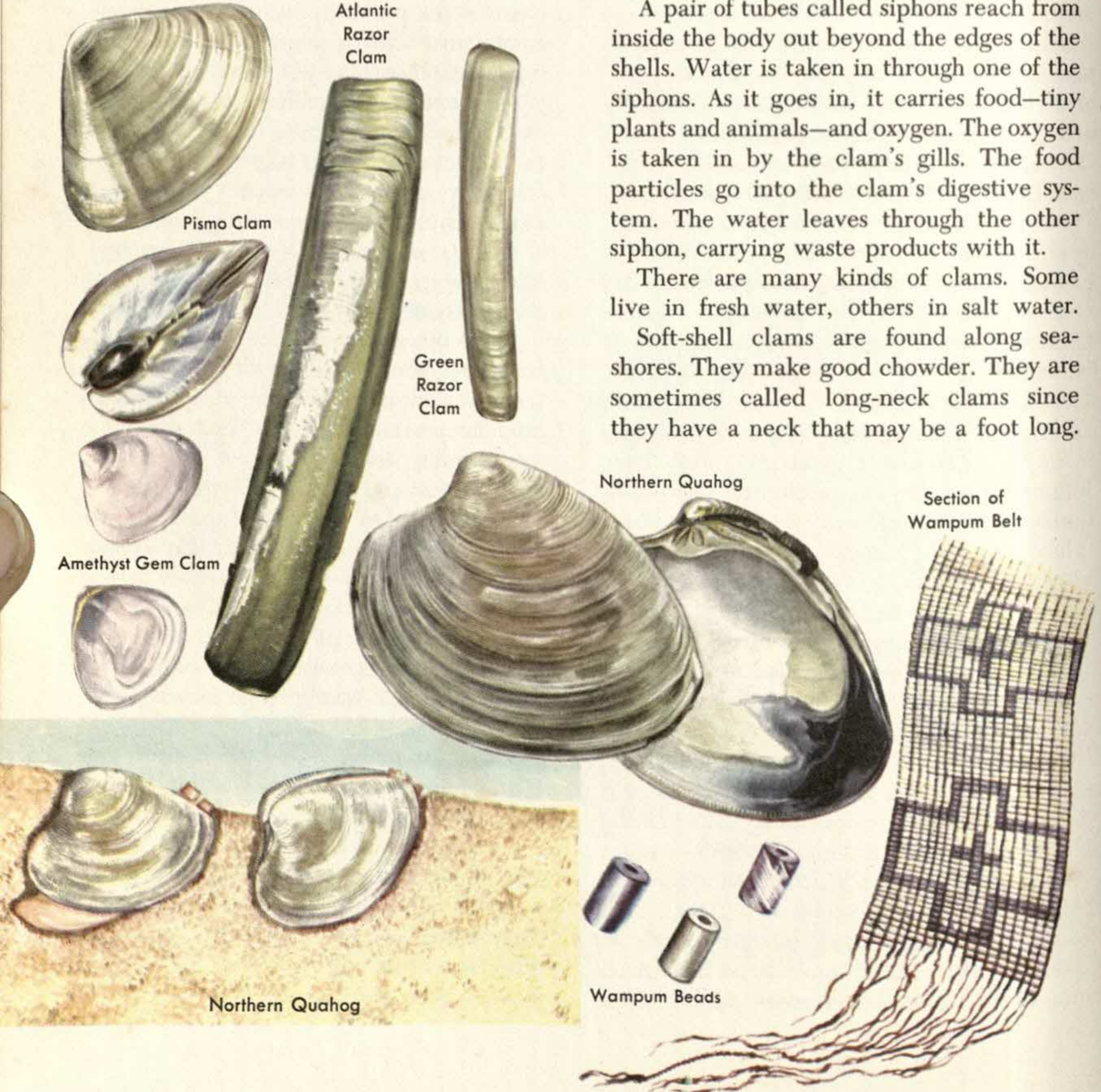
Clams belong to the big group of animals called mollusks. They are close relatives of the oysters and scallops.

A clam has one foot. This foot is a better tool for digging and burrowing than it is for walking. The foot plows into sand or mud, pulling behind it the sharp edges of the shells. A clam can dig itself in and be out of sight in seconds.

A pair of tubes called siphons reach from inside the body out beyond the edges of the shells. Water is taken in through one of the siphons. As it goes in, it carries food—tiny plants and animals—and oxygen. The oxygen is taken in by the clam's gills. The food particles go into the clam's digestive system. The water leaves through the other siphon, carrying waste products with it.

There are many kinds of clams. Some live in fresh water, others in salt water.

Soft-shell clams are found along seashores. They make good chowder. They are sometimes called long-neck clams since they have a neck that may be a foot long.



The neck is made up of the two siphons covered with a leatherlike skin. The siphons point up out of the mud or sand. When the tide is out, little holes and sometimes little spouts of water show where clams are hidden.

Hard-shell clams, or quahogs, are also found along seashores. They, too, are good food. Wampum, or Indian money, was made from their shells. Small quahogs are sometimes called littleneck clams. Another name for them is cherrystones.

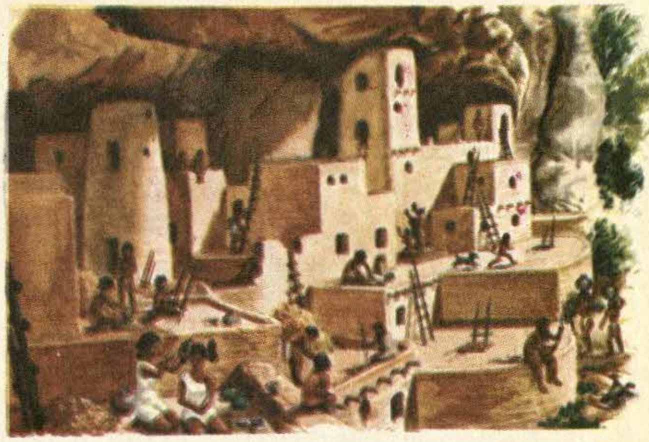
The giant clam of the Pacific is really a giant. It may weigh half a ton, and its shell may be four feet across.

Some freshwater clams are hitchhiking parasites for a part of their lives. The eggs of these clams hatch inside the mother's body. They soon leave through the siphon. Out in the water they die unless they can fasten themselves to a fish's skin or gills. They travel about on the fish, getting food from it until they grow up. (See MOLLUSKS; SHELLFISH; SHELLS.)

CLIFF DWELLERS Scattered over the Southwest there are many ruins of Indian villages like the one in the picture. Some are on the ledges of steep cliffs. Others are in shallow caves in the cliffs. We call the Indians who built these villages the cliff dwellers.

The cliff villages were built 200 or more years before Columbus discovered America. They had all been given up before any white men saw them.

The cliff dwellers were farmers. They raised corn and beans on level land nearby. They raised pumpkins and sunflowers, too. They did not have any horses or chickens or pigs or cows. But they did have tame turkeys and dogs. To add to the food they raised, they gathered nuts and berries and killed deer, rabbits, and wild birds. Probably the hunters sometimes brought home bears and porcupines for food.



These Indians of long ago made beautiful pottery decorated in many colors, and they wove cotton cloth. They had jewelry made of shells and of turquoise, and feather robes to wear when it was cold.

Some cliff houses were built of sun-dried brick, others of stones fastened together with clay mortar. Many of the walls were covered with plaster. Some inside walls had pictures painted on them.

A cliff dwelling held many families. Each family, however, had only one room. The lower, inner rooms were used for storage and the upper ones for living. Special underground rooms were meeting places.

Many houses were built right against the cliff. They had only three man-made walls. The cliff made the back wall. Some rooms were even dug out of the solid rock.

The ruins of the cliff dwellings are hard to reach. It is not easy to see why the builders chose cliffs as homesites. The rock walls, of course, did protect their villages from wind and rain and enemies. But probably this is not the whole story.

No one knows the whole story of why the cliff dwellers left their villages, either. A long drought is thought to have been the chief reason for their going. We know that about 700 years ago there was a period of 25 or so very dry years. But there may have been other reasons why they left.

The Pueblo Indians of today are the great-great-many-times-great-grandchildren of the cliff dwellers. Their customs preserve many of the ways of life of their ancient ancestors. (See INDIANS, AMERICAN.)

Cold winters, . . .

CLIMATE The climate of a place is the year-round weather there. A region may have a dry climate or a wet one. It may have a warm climate or a cold one. The weather may be about the same all through the year, or it may change often. There are many different types of climate.

The climate of a place has a great deal to do with what plants and animals live there. It also has a great deal to do with how the people of the region live. What they eat and what they wear depend partly on the climate. So do what kinds of houses they build and how they earn a living. Climate even has a great deal to do with how people have fun. (See WEATHER.)

warm summers, . . .

and cool autumns are all part of climate.

CLOCKS AND WATCHES About 1,000 years ago a monk named Gerbert made a timepiece which people called magical. It may have been the first real clock. No one can be sure, for the records do not tell how it worked. And at the time many writers used the same word for any kind of timepiece. But at least there were almost surely clocks of a sort in several European monasteries 800 years ago.

The first clocks we are certain of were made toward the end of the 13th century. The oldest clock in existence today is in Salisbury Cathedral in England. Built in 1386, it is still in working order.

Many early clocks had no hands and no faces. They told time simply by striking the hour. Bells were important parts of these clocks. The word "clock" comes from the French word *cloche*, which means "bell."

The bells of some of the early clocks were struck by hammers held in the hands of figures of people. These figures were called jacks, or jacks-o'-the-clock.

One early clock in France is three stories tall. Each quarter of the hour is struck by a different jack. The four jacks are figures of a little boy, a middle-aged man, an old man, and a skeleton. At noon there is a procession of the Twelve Apostles and a cock appears above them. It flaps its wings and crows three times. This remarkable clock also tells the day of the week, the day of the month, the position of the planets, and the phase of the moon.

Although some of the early clocks were complicated, none were very good timepieces. In all of them a falling weight turned wheels around. Winding the clock in those days meant lifting up the weight to its starting point. There was a device that let the weight drop a little way, then stop, then drop a little more, and so on. But for a long, long time there was no way of letting it down so that it would turn the wheels at just the right speed to keep time correctly.

The earliest clocks with hands had only the hour hand. There was not much point to having minute hands on clocks that might well lose or gain from half an hour to two hours in a single day. In many cases the hour hand did not turn. Instead, the face with the hours marked on it turned.

In the early 1500's the first watches were made. Of course, there could not be a falling weight in a watch. In place of the weight there was a spring. At about the same time that the first watches were made, clocks with springs were also made.

Some of the early watches struck the hours, but most did not. The ones that did not strike had to be looked at, or *watched*. It is easy to see how they came to be called watches. The first watches did not tell time very well. In fact, they were such poor timekeepers that people called them "ticking toys." Watchmakers were often called toymen. The watches they made were beautiful and very expensive. Rich people bought them for their beauty more than for their usefulness. Many who wore watches carried little pocket sundials to really tell the time.

Watches came to be made in all sorts of queer shapes: flowers, butterflies, crosses, and even skulls. Some were set in rings. One ring watch, made for a lady, had a little jack-o'-the-clock that tapped the lady's finger every hour. Many watches had jewels set in their cases.

Late in the 17th century a better way was worked out of making the watch spring unwind at the right speed. A little flywheel and a very fine spring started and stopped the wheels. Then watches were accurate enough to make minute hands worthwhile.

A way of making the wheels of a clock turn at the right speed had already been found. It was the pendulum, invented in 1656. The first clocks with pendulums worked much like a grandfather clock of today. In a grandfather clock, as in earlier clocks, a falling weight turns the wheels. As the pendulum swings back and forth, it moves an arm which does the starting and stopping that make the wheels turn as they should. The ticktock is made as the arm catches one wheel time after time and then lets it go.

When pendulums were put on clocks, minute hands were added, too. By 1700 clocks lost or gained only seconds a day and watches only minutes. Not many years later second hands were added to both clocks and watches.

Nearly 275 years ago watchmakers began using jewels inside watches to make them

1700

...TE OF EDUCATION
1932
3379
Govt. of West Bengal

run better. The rubies and sapphires used are so smooth and hard that they make the friction in the watch much less.

In 1714 the British government offered a prize of £20,000 to anyone who could make a timepiece that would keep time accurate enough for ships to tell their true positions at sea. It was nearly 50 years before the prize was claimed. The winning timepiece was only five seconds off after a five-months voyage. The timepiece was called a chronometer. From chronometers, watch- and clockmakers found ways of making their clocks and watches better.

Before the middle 1800's all clocks and watches were handmade. Then in America and Switzerland machines were invented for making them. Clocks and watches could be made faster and more cheaply by machine.

When the first watch company of America was founded, one of the men in it boasted that the company could make seven watches a day. His friends laughed. "Where," they asked, "could you sell seven watches a day?" They did not guess that in less than a hundred years factories would be making thousands of watches a day and millions of people would be wearing them.

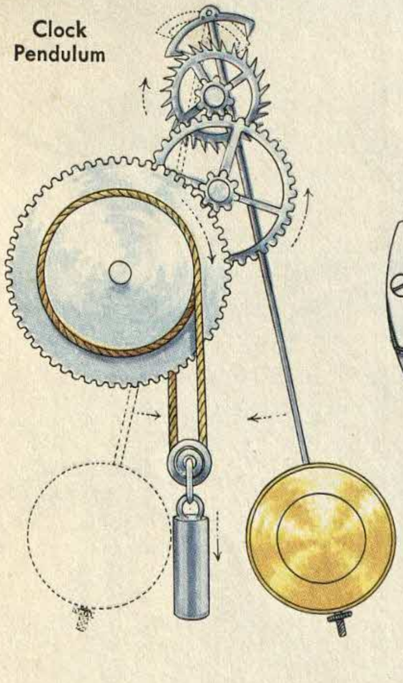
Today's factories turn out cheap watches and fine ones. They make self-winding watches, watches that ring an alarm, and watches that tell the day and month as well as the time. They make watches that can time happenings to the hundredth of a second. The difference of a hundredth of a second may decide whether a new world record in a dash or a ski run has been made. It may decide more important things, too.

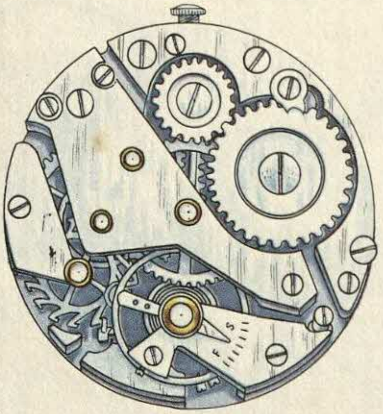
Now many clocks are run by electricity. They have no springs or weights. Electric clocks are good timekeepers.

There are electric watches, too. Tiny cells furnish the electric current needed. In the electric watch pictured, the current keeps a tiny tuning fork vibrating. This tuning fork drives the works. If you hold such a watch up to your ear, you hear, instead of ticking, a faint hum. Watches of this kind are very accurate.

And now there are atomic clocks that are far more accurate than any others. A cesium clock, for instance, will not lose or gain more than a second in 30,000 years. But scientists are not satisfied. For such things as space probes, satellite tracking, and studying the stars, they want a clock that will not lose or gain more than a second in 3,000,000 years! (See BELLS; TIME AND TIME TELLING.)

Clock Pendulum





Works of Watch with Mainspring

Works of Electric Watch

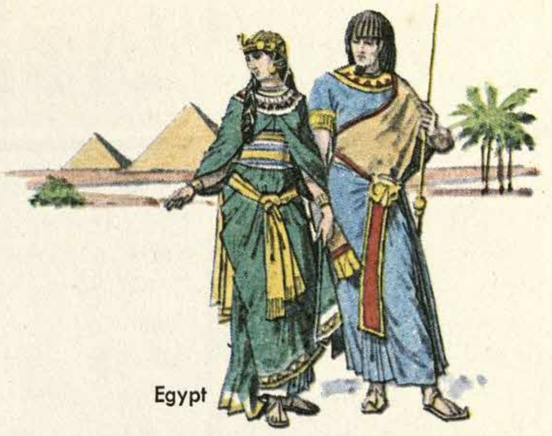
CLOTHING It would be foolish for an Arab and an Eskimo to dress in the same way. The loose, white robes worn in Arabia reflect the glaring sunlight and keep their wearers from getting too hot as they go about in the desert. An Eskimo's two-layer hooded fur suit protects him from the wind and keeps him from getting too cold in the icy lands where he lives. Different climates call for different kinds of clothes. For we wear clothing at least partly for protection from the weather.

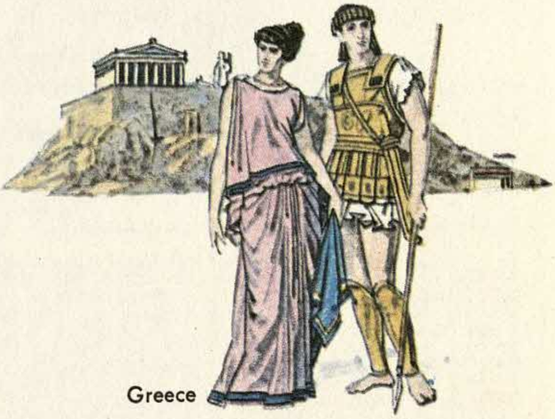
We wear clothing for another reason, too—for decoration. Strangely enough, scientists believe that people wore clothing for decoration before they started wearing it for protection. The people of many savage tribes still wear little or no clothing, but they do decorate their bodies. When they want to dress up for a special occasion they may put on feathers, paint, or jewelry.

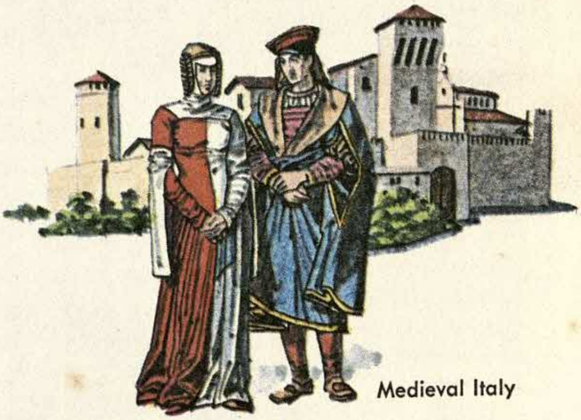
It used to be easy to tell what country a person was from by looking at his clothes. But clothing habits in many countries are changing. For now that radio and television and airplanes have brought the different parts of the world closer together, ideas about clothes are spreading just as other ideas are. The people of some countries now save the costumes they used to wear every day for holidays. A traveler in Scotland, for instance, might not see any man wearing kilts. Many people in lands like India and China are changing from the kinds of clothing worn in those countries for centuries. Clothes like those worn in the United States are being worn in more and more places. This style of clothing is called "Western dress."

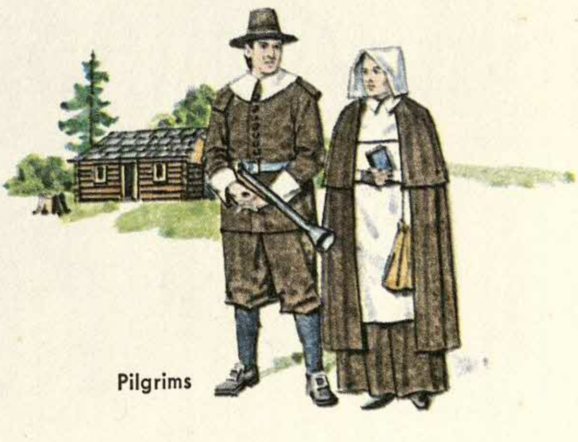
Since clothes are partly for decoration, it is not surprising that the style of our clothes changes with the years. Children's fashions change from year to year, just as those for grown-ups do.

Some people cannot always choose what clothes to wear. At times they must wear uniforms. A soldier's uniform tells everyone that he is a soldier. It tells, too, some-


Egypt


Greece


Medieval Italy


Pilgrims

In colonial America, women made much of the clothing at home.

thing about his duties and what his rank is. In India for tens of centuries people could wear only the clothes fitting to the caste to which they were born. Even in the early days of America Virginia and some of the other colonies had laws forbidding poor people to wear rich clothes.

Our earliest ancestors did not have many materials to choose from for their clothing. Animal skins, leaves, and grasses were about the only ones they could use. The first woven fabric that people learned to make was probably linen. They found out how to make linen thousands of years ago. This cloth is woven from flax fibers. The ancient Egyptians were weaving it on their looms long before the days of the pharaohs.

Probably the second cloth that men learned to weave was wool. Wool makes a cloth that is warm and lasts a long time. The ancient weavers even colored the wool to make it more attractive. They had red, blue, and yellow dyes.

Cotton and silk, too, go back thousands of years. People of India were weaving cotton cloth as long ago as 3000 B.C. The Chinese carefully guarded the secret of making silk for centuries. Anyone who told how it was done, the emperor decreed, would be put to death. In time, however,

Arabia

Japan

Peru

Samoa

India

Zanzibar

the secret did leak out. It got to the Near East in the sixth century, when two Persian monks who had been living in China hid some silkworms in their bamboo canes and brought them to Constantinople. Silk was among the riches that Crusaders and traders of the Middle Ages brought back to Europe from the East.

Today there are hundreds of materials for clothing, and new ones are being invented. Rayon, nylon, dacron, and orlon are the best-known man-made fabrics used for clothing.

Fortunately, we have given up some styles in clothing that were not good. Women in the United States and Europe until about 60 years ago had their dresses made with tiny waists. They had to lace themselves into tight corsets to be able to wear the dresses. Such tight lacing was not good for anyone. Women's dresses, even their everyday dresses, once swept the ground. They gathered up dust and germs. Children's clothes, especially their dress-up clothes, used to be so fussy that the children could not run and play in them.

In most parts of the world people have more clothes than they used to have. Sewing machines help explain why. It is easy to buy ready-made clothes now, too—clothes made in factories. The amount of money the people of the United States spend for ready-made clothes is hard to imagine. It amounts to 20 billion dollars a year! (See HATS AND CAPS; JEWELRY; SHOES.)

Eskimo

Western Dress, 1960's

CLOUDBURST At times rain pours down so fast that it is as if an enormous bag full of water had burst open and spilled all its water at once. A rain of this kind is called a cloudburst. Usually the downpour comes during a thunderstorm.

A cloud cannot really burst. A rain cloud has nothing on the outside to shut in its billions of droplets of water. But, even when the droplets become big drops, strong upward currents of air may keep them from falling. At last, however, the drops are too big and heavy to be held up. They fall with a rush, and we have a cloudburst.

Cloudbursts are far more common in mountainous regions than on open plains. There are more apt to be upward currents of air there strong enough to build up big loads of waterdrops before they weaken. Floodwater from the cloudbursts may do a great deal of damage as it rushes down mountain valleys.

In a cloudburst enough rain to make a layer several inches deep on the ground may fall in a very short time. In Holt, Mo., for instance, 12 inches of rain fell in one hour on June 22, 1947. This is more rain than many parts of the world get in a year. And at a camp in the San Gabriel Mountains in California on April 5, 1926, more than an inch of "April showers" fell in just one minute! (See FLOOD; RAIN; U.S. WEATHER BUREAU; WEATHER.)

CLOUDS On some days no blue sky shows. The sky is covered all over with a layer of clouds. On other days the clouds do not cover the whole sky, but big white clouds go sailing by. Sometimes there are feathery clouds high in the sky. Sometimes, too, there are dark storm clouds.

Clouds are made mostly of tiny drops of water or of tiny crystals of ice. They are like the little clouds over the spout of a teakettle, or like those from a person's breath on a winter day.

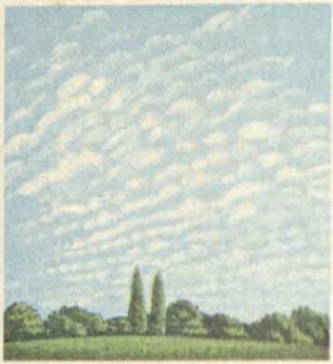
Storm clouds may be dark because a great deal of dust has been blown up into them. But usually clouds are dark simply because they are too thick to let much sunlight through. Even if clouds are dark from below, they are shining white from above.

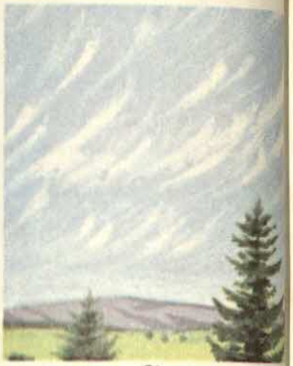
The big, fluffy white clouds that look like piles of cotton against the blue sky are cumulus clouds. "Cumulus" means "pile." The base of a cumulus cloud is usually less than a mile above the ground, but the top may tower several miles higher.

The clouds that make a low gray layer over the sky are called stratus clouds. "Stratus" means "layer."

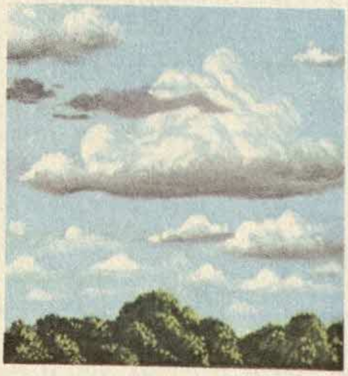
The feathery white clouds are cirrus clouds. "Cirrus" means "curl." These clouds sometimes look like curls of smoke. Some cirrus clouds are so long and narrow that they are called "mare's tails." Cirrus clouds are high above the ground—usually from three miles or so to nine miles up.

Some clouds high above the ground are both cirrus-like and cumulus-like. They are called cirrocumulus. Clouds of this kind make what is called a mackerel sky.


Cirrocumulus


Cirrus

Stratus


Cumulus

There are many other kinds of clouds, too. Often two or three different kinds can be seen at the same time.

The drops of water or bits of ice in clouds are usually very tiny. They are so tiny that more than 100 million of them could be put in the bowl of a teaspoon. At the center of each water droplet or ice crystal there is usually an even tinier speck of dust. The water and ice in clouds come from the water vapor in the air. The water vapor is more likely to change to water or ice if there is a solid speck of something in the air for the water or ice to form around.

The sky may be very cloudy at one moment. Rain or snow may be falling from the clouds. But half an hour later the clouds may have disappeared and the sun may be shining brightly.

Clouds sometimes disappear because the wind blows them out of sight. They sometimes disappear because the water or ice in them evaporates. The water or ice changes back, that is, into invisible water vapor. A cloud may disappear because the water or ice in it has fallen to the ground as rain or snow. A dark cloud may not disappear after rain or snow has fallen from it. But it is almost sure to be lighter.

Millions of people have gone through clouds in airplanes. Going through a cloud is like going through a heavy fog. No wonder! A fog is a cloud close to the ground. (See FOG; RAIN; U. S. WEATHER BUREAU; WATER; WEATHER.)

CLUB MOSSES Names do not always tell a true story. Ground pines, common in woods and used as Christmas greens, are not pines. Instead, they are club mosses. Club mosses, in turn, are not really mosses. They are much closer relatives of horsetails and ferns than of mosses.

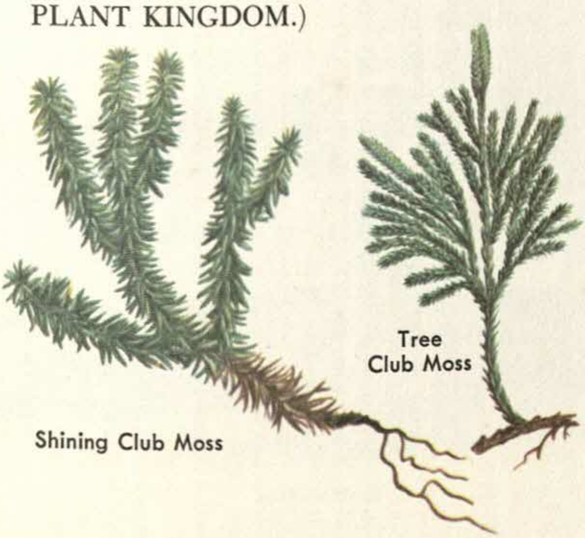
There are several hundred kinds of club mosses. Some grow in northern forests. But many live only in very warm lands.

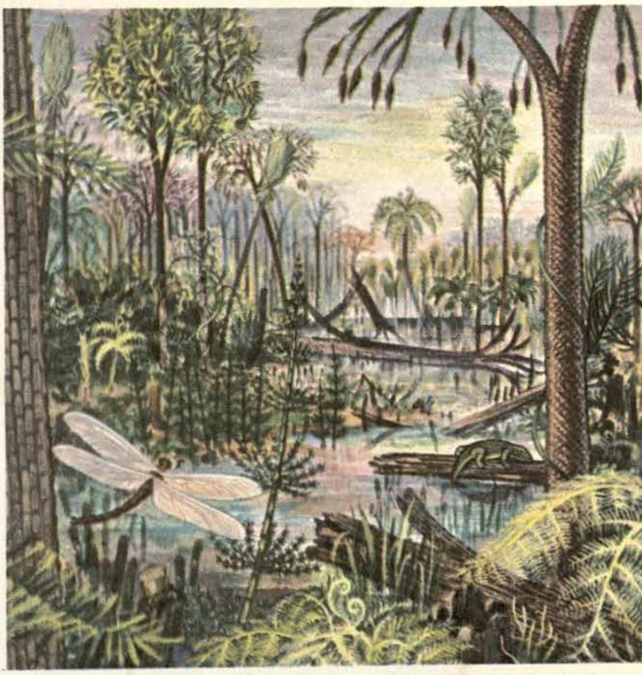
Club mosses have small leaves. The leaves grow close to the stems.

These plants never bloom. They do not produce seeds. New plants grow from tiny balls of living material called spores. Many simple plants grow from spores.

All the club mosses of today are small plants. But 300 million years ago, during the Coal Age, the story was very different. Then giant club mosses were among the tallest trees in the forests. The two thick-trunked trees in the foreground of the Coal Age picture are club mosses. Much of our coal was made from the forests in which these giant club mosses grew.

There were still giant club mosses in the early days of the dinosaurs. The club mosses, however, could not hold their own with the seed plants, which by that time had begun to "take the earth." Only small kinds of club mosses were able to live on. But whenever we come across ground pine it will perhaps remind us that its ancestors were once among the world's leading plants. (See COAL; FERNS; HORSETAILS; PLANT KINGDOM.)





COAL Marco Polo had many wonderful stories to tell when he came home to Venice from China more than 600 years ago. One of his stories was that the Chinese used a kind of black rock as fuel. Not many people in Europe at that time had heard of the black rock that burned. Today so much of it is used throughout the world that it keeps hundreds of thousands of men busy digging it out of the ground. The black rock, of course, is coal.

Coal is sometimes called "black diamond." It gets this name because it is mostly carbon, and diamonds are crystals of carbon. Another nickname for coal is "buried sunshine." It gets this name because it was made from forests of long ago. To grow, the forests had to have sunshine.

The story of most of our coal begins about 300 million years ago in a time called the Coal Age. Much of the world was warm, and much of the land swampy. Great forests grew in the swamps. They were not like today's forests. The trees were mostly giant ferns, club mosses, and horsetails.

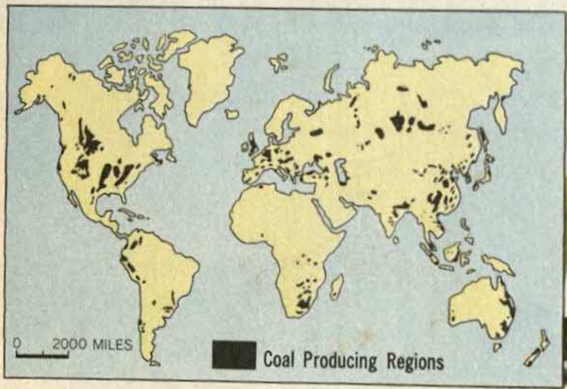
In the forests no birds flew among the trees. There were no birds in those days. But there were dragonflies and cockroaches bigger than any we have now. There were no lizards or squirrels. In fact, there were few reptiles and no furry animals at all. But there were giant amphibians, ancient relatives of today's toads and frogs.

None of the trees in these forests were ever cut down. There were no people to cut them. But trees died and fell over into the shallow water, and other trees grew in their places. The dead trees did not all rot away. Something in the water kept them from doing so. The bottom of the swamps came to be covered with a thick layer of half-rotted plant material. It was much like the peat found in peat bogs today.

After a long, long time the water in the swamps became so deep that the forests were drowned. Perhaps the land sank. Perhaps the oceans rose and flooded the land. No one knows which. The drowned trees fell over and made the layer of plant material at the bottom of the water thicker. Mud washed in on top of it.

The same thing happened not once but many times. The land rose or the oceans sank, and the land was swampy again. Forests grew. The land sank or the oceans rose, and the forests were drowned and covered with mud. There came to be layers of buried plant material like the layers in a layer cake. The mud was the "filling" between the layers.

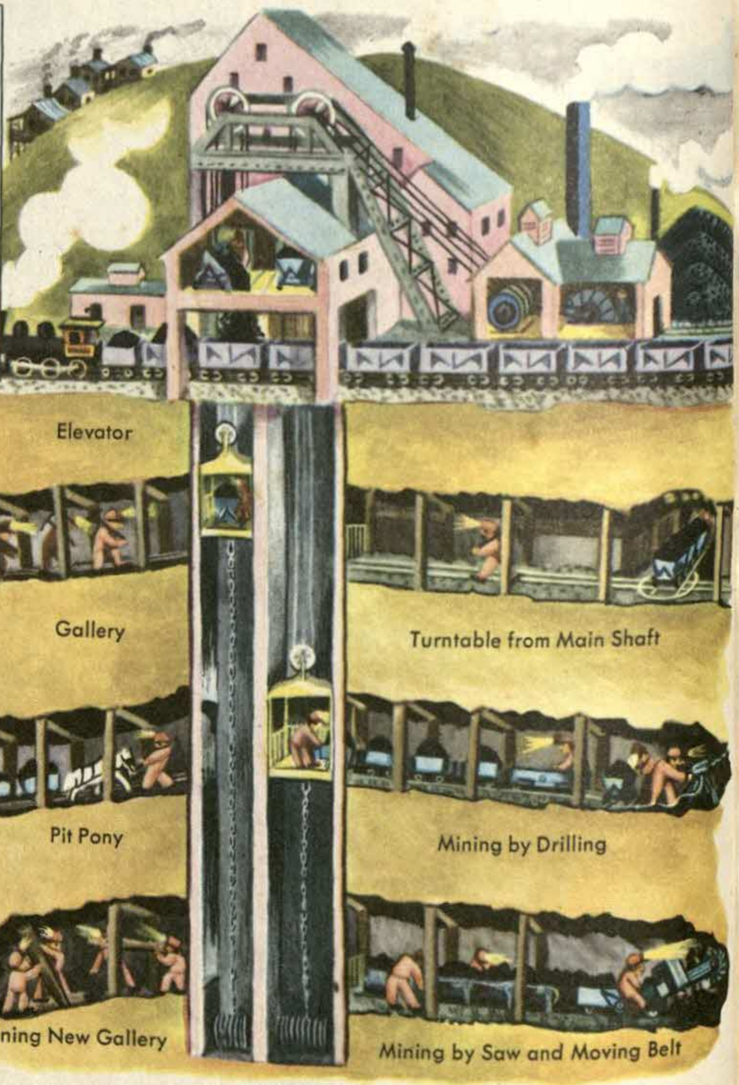
Finally the great swamps became dry land. The layers of half-rotted plants had



Anthracite

Bituminous Coal

Lignite



Shaft Mining

been squeezed into thinner layers of black material. It hardened into coal. The mud hardened into the rock we call shale.

The Coal Age ended about 280 million years ago. But some coal was made later.

All coal was made from plants. But there are different kinds of coal. Ordinary black coal is often called soft coal. Another name for it is bituminous coal. Some coal, after it was made, was squeezed so much that it became much harder than ordinary coal. It is called hard coal, or anthracite. "As black as coal" is a common saying, but not all coal is black. Lignite is brownish instead. Lignite is softer than soft coal. Cannel, or "candle," coal lights more easily than common coal.

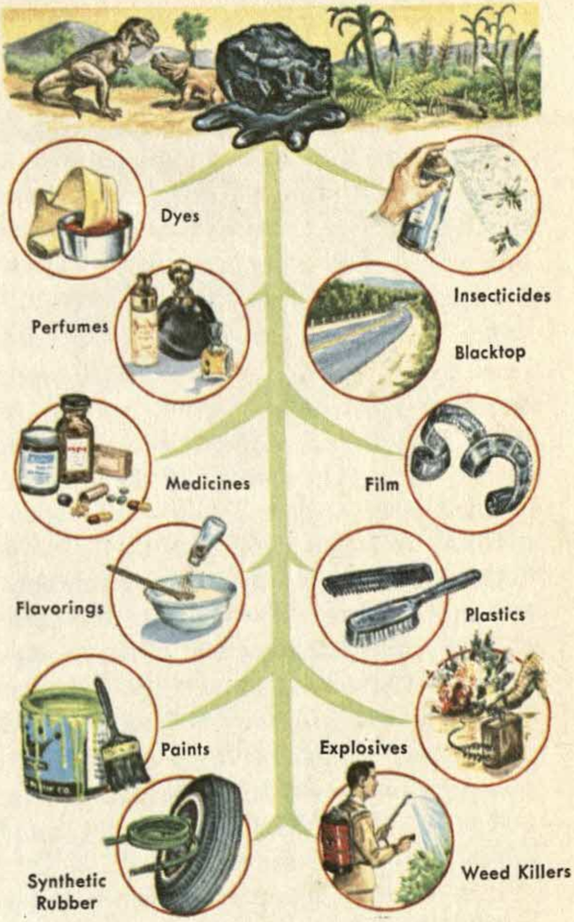
Peat is sometimes called "unfinished coal." If peat were buried under layers of mud for thousands of years, it would finally turn into coal.

Some layers of coal are so near the surface that we can get the coal just by shoveling off the rock and soil on top. Mining of this kind, usually done with giant power shovels, is called strip mining.

Much coal mining is shaft mining. A big hole, or shaft, is dug down into a layer of coal. Then the miners work out in all directions from the bottom of the shaft.

Although working in a deep coal mine is dangerous, it is not as dangerous as it used to be. Many things have been done to protect the miners. Mines, for instance, are now ventilated. And the men no longer wear lamps that are likely to set fire to gases and cause explosions.

Oil and natural gas have taken the place of coal as a fuel to some extent. But in the world as a whole coal is still the chief source of power. And we use hundreds of products made from it. Among them are coke, important in getting iron from its ores, coal tar, from which an amazing number of useful substances are manufactured, and coal gas. So far as anyone can see, we shall keep on needing millions of tons of this black rock every year. (See PEAT.)



COAL TAR Much of the coal we mine is used in making coke. When coke is made from coal, a sticky black liquid called coal tar is left over. Coal tar used to be thrown away. But now so many uses have been found for it that it is as valuable as the coal itself. It makes good fuel. Besides, hundreds of products are manufactured from it. The chart shows some of them. Who would guess that such things as perfumes and dyes and flavorings could come from something that was once just a nuisance?

The first step in getting the products from coal tar is to heat the tar in big closed tanks. Pipes lead off from the tanks. Coal tar is a mixture of many chemicals. As it is heated, first one chemical and then another is driven off through the pipes. The many products of coal tar are made from these chemicals. (See COAL; DYES; FLAVORING; PERFUME; PLASTICS.)

COCONUT A cluster of coconut palms is a common sight on tropical shores. The seeds of these palms are called coconuts. They are among the biggest of all seeds.

A coconut has a thick husk around it when it comes from the tree. Fibers from this husk can be used in making brushes, brooms, and rope. They can also be used in weaving such things as mats and baskets.

But the seed inside the husk is much more important. The seed has thick walls of white meat. The coconut we eat in candy, cakes, and pies is made of shreds of this meat. The center of the coconut is filled with a clear liquid called coconut milk. It is good to drink.

Coconut meat is oily. Many plantations in tropical lands raise coconuts for their oil. They ship dried coconut meat, or copra, to the United States and other countries. There the oil is removed. Some is sold for cooking. Much of the rest goes into margarine, soaps and detergents, face cream, and safety glass. What is left of the meat makes good livestock feed.

It is not easy for any creature except a monkey to gather coconuts from coconut palms. These palms may be as tall as a ten-story building. And there are no branches to serve as a ladder.

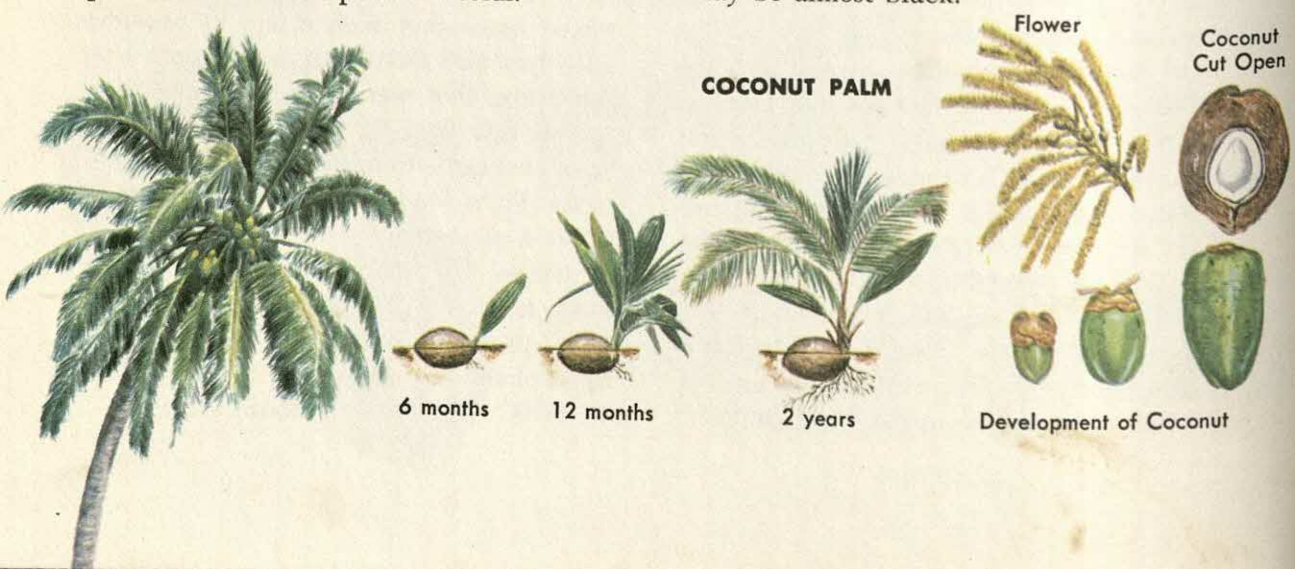
Even if they did not bear coconuts, coconut palms would be valuable. Their huge leaves are useful for thatched roofs. Their trunks, used in building native homes, also furnish "porcupine wood." In fact, every part of the coconut palm is useful.

COFFEE Many men and women think that a day cannot start right without coffee for breakfast. Coffee is probably the best liked of all hot drinks. Americans drink more than 250 billion cups of coffee in a year's time.

Coffee is made from coffee beans. Coffee beans are not really beans. But they are seeds just as beans are. They are formed in red cherrylike berries. Each "cherry" has two seeds in it. The plant on which the coffee cherries grow is an evergreen bush from 5 to 15 feet tall.

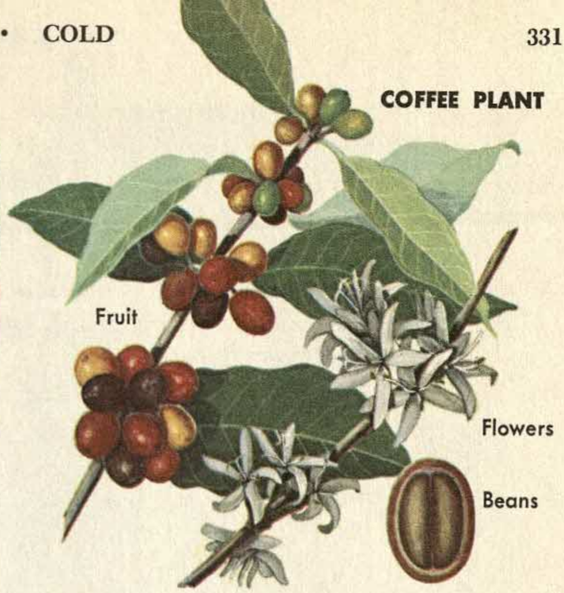
Coffee grows only in warm lands. It cannot stand the least bit of frost. But it cannot stand great heat, either. Many coffee plantations are on mountain slopes, where the coffee plants are shaded part of the day. Coffee needs rich soil. It needs much rain while the cherries are forming and much sunshine while they are ripening. Most of our coffee comes to us from northern South America and from the countries of Central America. About half of all the coffee the world produces is coffee grown in Brazil.

A coffee plantation is a beautiful sight when the coffee bushes are in bloom. The blossoms show very white against the glossy green leaves. They are as fragrant as orange blossoms. When the flowers drop their petals the fruits appear. At first they are tiny and green. As they get larger they change first to yellow, then to bright red. When they are ripe they are dark red. Some may be almost black.



COCONUT PALM

Coffee Plantation



The cherries are picked when they are ripe. The next step is to take all the outer part of the fruit away from the beans inside. There are two ways of doing so—the "dry" way and the "wet," or wash, way.

In the dry way the cherries are rinsed quickly in water. Then they are spread out in the sun and left there for three or four weeks. When the cherries are dry and shriveled, the beans are hulled. After several days of drying they are ready to ship.

In the wash way the outside skin of the cherry is taken off at once. Then the jelly-like pulp around the beans is made to ferment slightly. It gets loose enough to be washed off the seeds. The seeds are then dried in the sun. When they are dry they are put through a hulling machine that cracks and removes the two thin "skins" that cover the seeds.

Before coffee beans are used, they must be roasted and ground. Coffee does not keep its flavor long after it is roasted. The beans that are to be shipped to another country are therefore shipped "green," which means "before roasting."

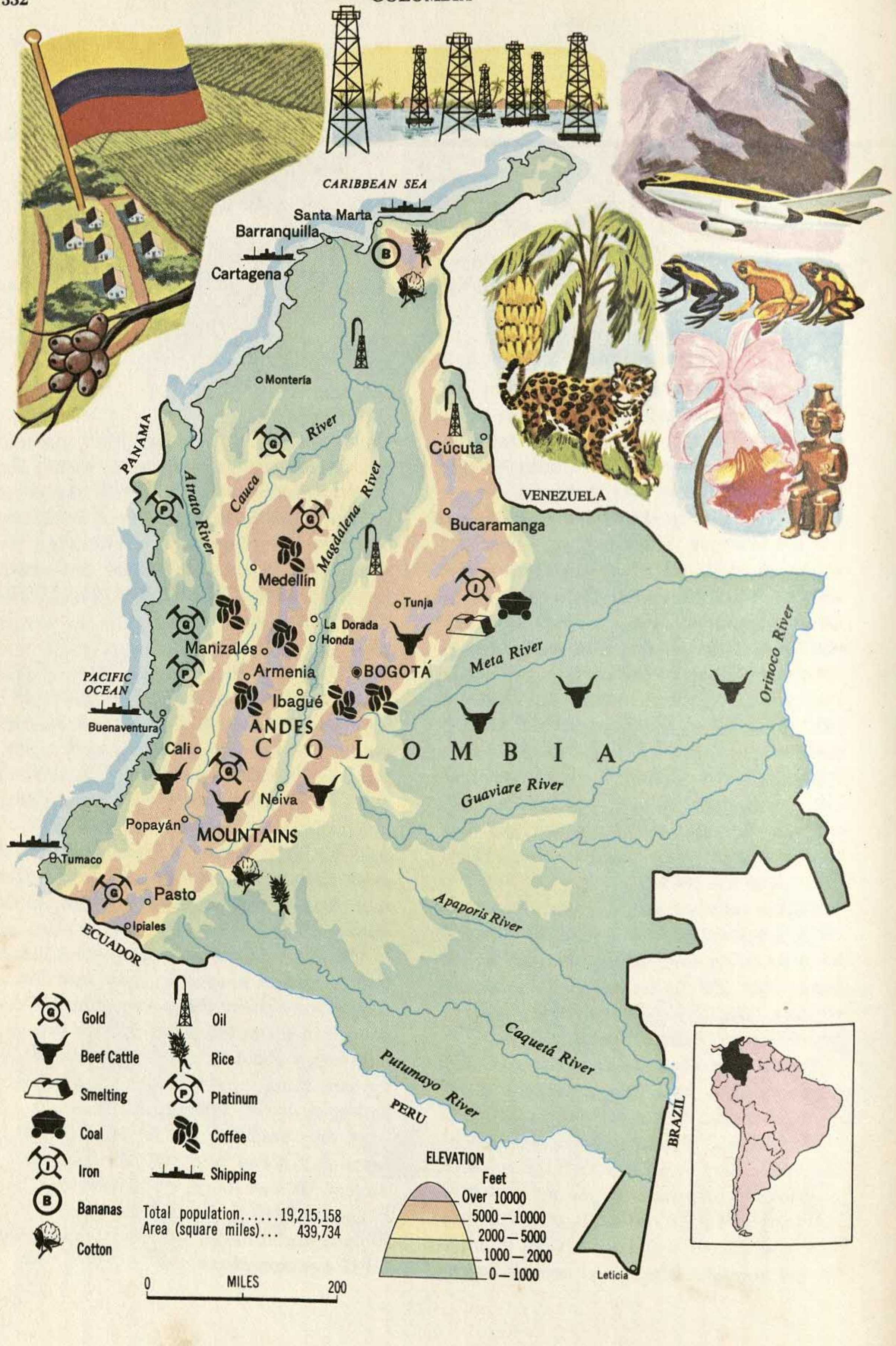
Not all coffee has the same flavor. Coffee in the stores is, as a rule, a mixture of two or more kinds. Mixing coffee of different kinds is called blending. Most people who like coffee very much have a favorite blend.

Drinking coffee makes a person more wide-awake. There is an old Arab story that tells how a goatherd was kept awake at night by his animals. The goats were romping about instead of sleeping. The goatherd found that the animals were eating the berries from some wild bushes. He ate a handful of the berries himself and found that he then felt very energetic. In this way, the story says, people first found out about coffee. (See BRAZIL; CENTRAL AMERICA; COLOMBIA.)

COLD In Antarctica temperatures of 125 degrees below zero Fahrenheit (–125° F.) have been recorded. But no place in Antarctica comes near to being as cold as anything can be. Men have learned to produce much lower temperatures. The temperature of liquid air, for instance, is about –315° F. And the temperature of liquid hydrogen is more than a hundred degrees lower than that! The science of cryogenics has to do with extreme cold.

The space age made cryogenics important. Scientists needed to know how low a temperature living things can endure. They needed to know, too, what changes extreme cold brings about in many materials. What, for one thing, could containers for liquid hydrogen, a fuel for rockets, be made of?

As they studied extreme cold, scientists found that it can be useful in medicine and surgery. It can be used to deaden pain. It can be used to destroy certain kinds of tumors. And it has proved remarkably helpful in eye operations.



Total population......19,215,158
Area (square miles)... 439,734

COLOMBIA Only one country in South America has seacoasts on both the Pacific Ocean and the Caribbean Sea. This country is Colombia.

The country was named Colombia for Christopher Columbus. But for many years before it was given that name, Spanish settlers there called it New Granada.

Colombia is a land of very high mountains, high plateau land, and much hot, wet lowland. Some of that lowland is along the Pacific. Some is along the Caribbean. The whole southeastern part of Colombia is lowland, too. Between it and the other lowlands there are mountains.

The mountains are the Andes. Some of the peaks are so high that they are snow-capped all year round, even though they are near the equator. The plateau land and mountain valleys are pleasantly cool.

The southeastern lowland is much shut off from the rest of the world. Most of the few people there are Indians.

Some of the people of Colombia are pure Spanish. Some are Negroes; they are descendants of slaves brought to the new land by the Spaniards. Most of the other people are part Indian and part Spanish.

There are some cities along the coast. But more than three-fourths of all Colombians live in the highlands.

Bogotá, the capital, is a pleasant highland city of nearly two million people. Spaniards settled there long ago. But Bogotá was hard to reach. For many years few newcomers came to it. Before the days of airplanes, the journey to it from the Caribbean coast took from one to three weeks. It was first by train, then by riverboat, then by train, then by boat again, and then by train. On the last part of the trip, the train climbed more than 7,000 feet. Airlines now make travel to Bogotá easy.

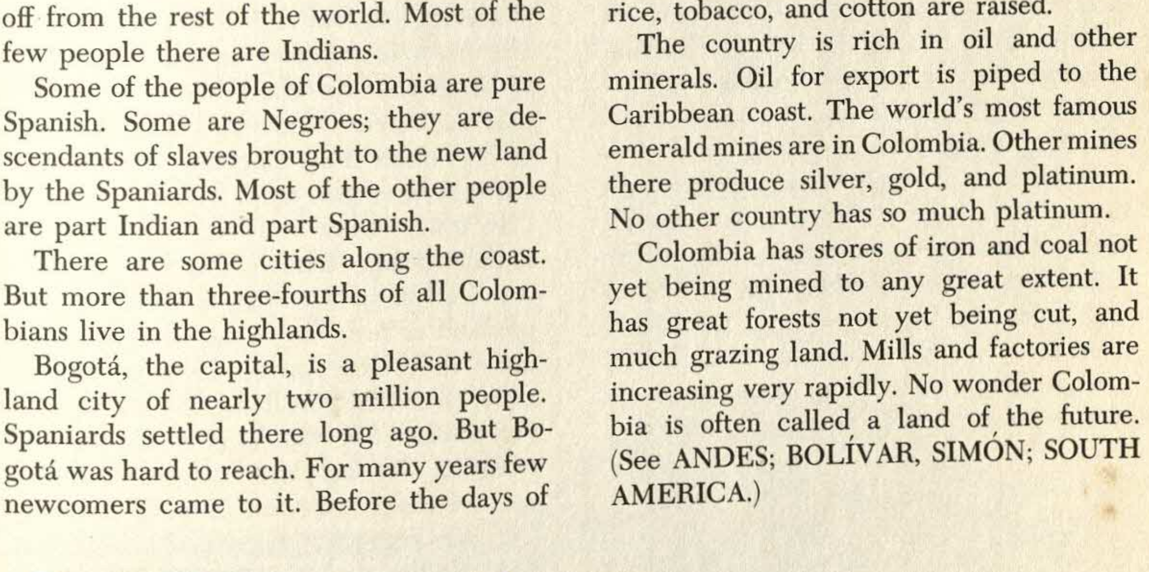
The first airline in Latin America was Colombian. Today, Colombian airlines are famous for the many tons of cargo they carry. A network of airways covers the country; there are more than 400 airfields. Bogotá has an international airport.

Much that early Spaniards brought to Colombia still remains. The language is Spanish. So are many of the customs.

The chief crop of Colombia is coffee. It is raised on slopes in the lower parts of the highlands. Wheat, oats, barley, and potatoes grow on higher land. On the lowland near the Caribbean, bananas, sugar, rice, tobacco, and cotton are raised.

The country is rich in oil and other minerals. Oil for export is piped to the Caribbean coast. The world's most famous emerald mines are in Colombia. Other mines there produce silver, gold, and platinum. No other country has so much platinum.

Colombia has stores of iron and coal not yet being mined to any great extent. It has great forests not yet being cut, and much grazing land. Mills and factories are increasing very rapidly. No wonder Colombia is often called a land of the future. (See ANDES; BOLÍVAR, SIMÓN; SOUTH AMERICA.)



COLONIAL LIFE IN AMERICA Axes ringing in the forests, great trees falling, log cabins rising like magic—these were early colonial days in America. In the cabins mothers prepared food in open fireplaces in black iron kettles. Families ate their meals at homemade wooden tables. They sat on stools. Their mugs were of English pewter and their plates of American "dishwood." There was one bed—for father and mother—fastened into the logs of a corner. Children slept on sacks of dried leaves covered with furs. A few families had brought a little furniture from England.

Families were large. Often there were ten or more children. The mother made all the clothes. She spun linen and woolen yarns on the spinning wheel and dyed them with goldenrod and berry juices. On a hand loom she wove the yarns into cloth called linsey-woolsey. From deer skins she made clothes for father and the boys.

Outside the cabin lay the cornfield among tree stumps. Nearby was the garden of pumpkins and beans.

With time, life in the New England colonies, the middle colonies, and the South came to be rather different. Later settlers from England and other European countries brought their own customs with them. Differences in the soil, climate, and available building materials helped to bring about differences in ways of living.

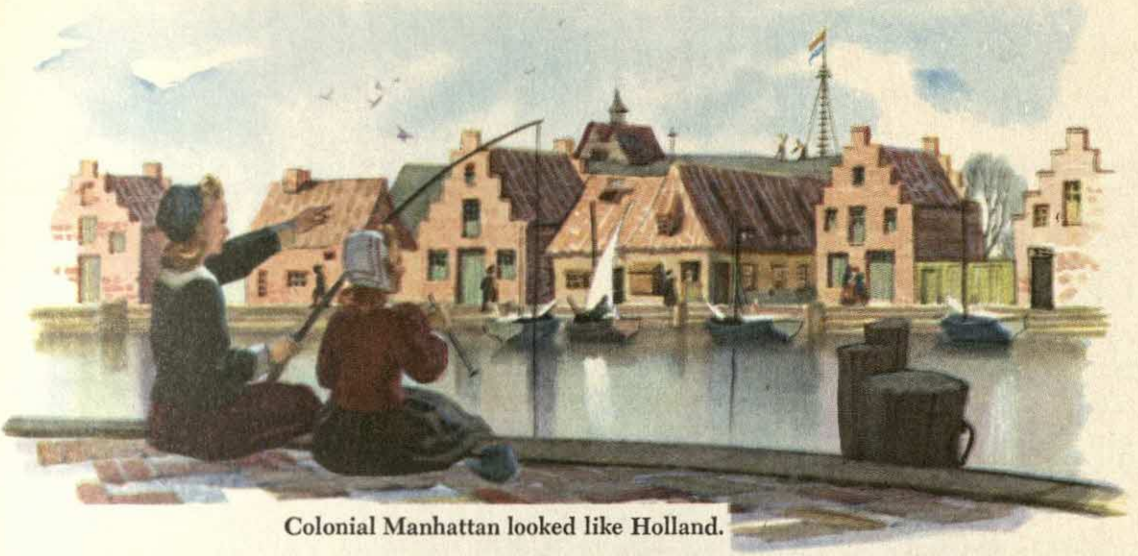
In New England most people lived in small towns, with their farms outside the town. These settlements were near the sea or tucked in mountain valleys. Cabins disappeared as houses of frame or stone were built. The roofs of the houses sloped steeply to shed the heavy snows. Women still cooked in open fireplaces of stone. Men went out to work their farms or they took to the sea for fish.

Mother now did not make all the clothes. The town dressmaker and the shoemaker came to work in many homes for several days each year. Some people could afford to buy cloth from England. They bought furniture, too, and table silver.

In towns there were enough people to support public schools. Families paid for their children's schooling in money or farm products or fish. They took turns furnishing firewood to the school. If they furnished none, their children had to sit far from the fire. Schoolwork was based on the three R's —reading, 'riting, and 'rithmetic. By the time of the Revolution New England had four universities to be proud of—Harvard, Yale, Brown, and Dartmouth.

New England children had many chores. Boys helped to collect stones from the rocky fields and to build them into stone fences. Boys and girls picked sackfuls of bayberries for their mothers' candlemaking. In seaport towns boys helped with shipbuilding. Many got their "sea legs" early and later became ship captains.

New Englanders were strict about attending church. Services lasted all day. People



Colonial Manhattan looked like Holland.

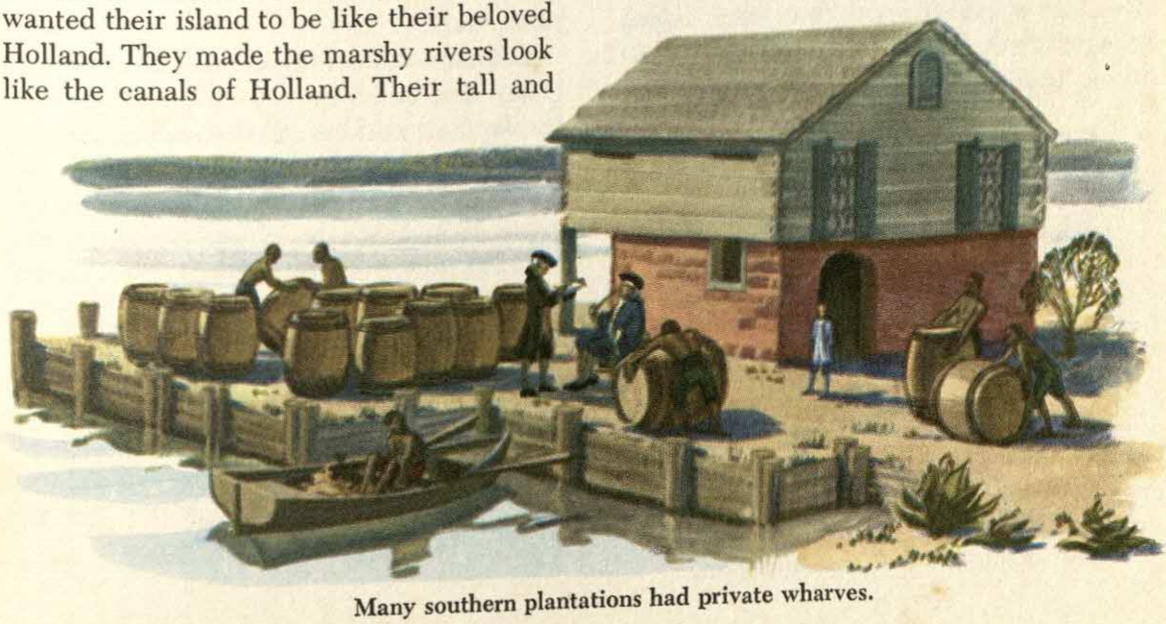
carried their dinners and ate them in the church or churchyard between services. During the lengthy sermons the tithingman kept the children awake. He had a long pole with a brass knob on one end and a squirrel's tail on the other.

In the middle colonies there were Dutch, German, Scottish, Irish, and English settlements. Many of the English settlers were Quakers. Farms, big and little, spread over broad valleys. The winters were more mild than in New England. Wheat and corn grew well. The farmers had flour and cornmeal and cattle to sell to the people of the towns. Children went to church schools.

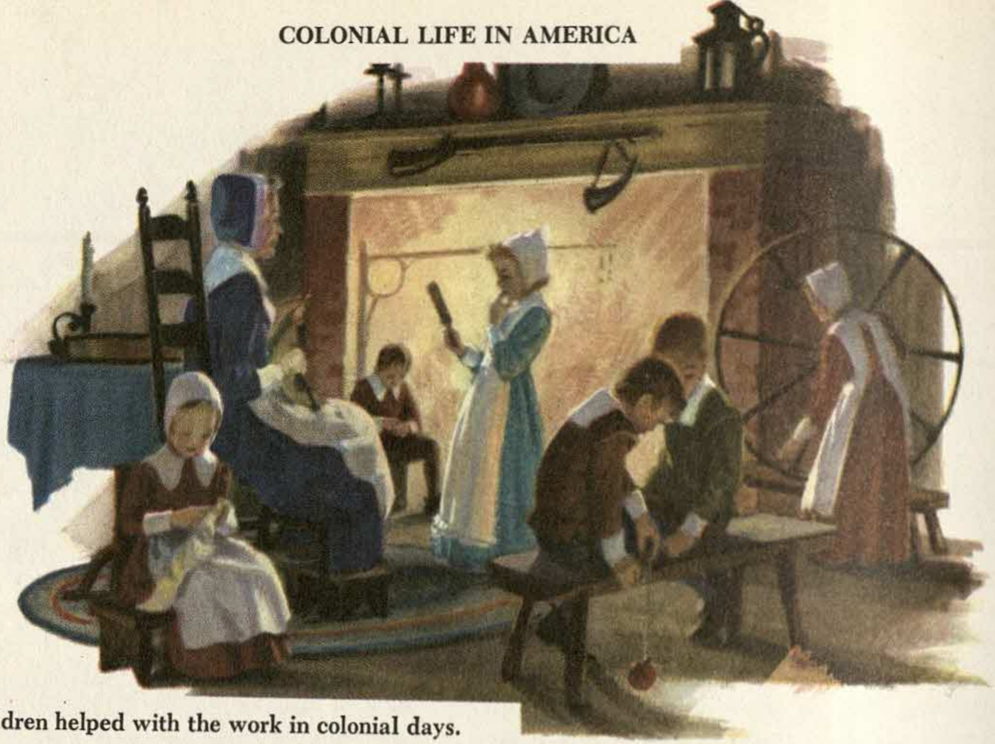
The Dutch settlers on the island of Manhattan, where New York City now stands, wanted their island to be like their beloved Holland. They made the marshy rivers look like the canals of Holland. Their tall and narrow brick houses faced the "canals." Windmills ground their grain. In winter girls in full skirts and boys with long, baggy breeches and beaver caps went skating.

The Dutch homes in America were much like those of Holland. The beds were built into the walls like cupboards. There were leather chairs from Holland. The fireplace was decorated with blue-and-white tiles. Housewives scrubbed their floors often and covered them with sand. Father and the boys ate dinner with their hats on.

The southern colonies had few towns. The farmers lived on their farms, separated by forests. A few of these settlers had large plantations. The planter's great house was built of brick. His green lawn, with shade



Many southern plantations had private wharves.



All the children helped with the work in colonial days.

trees and flower gardens, sloped down to a broad river. Near the great house were the family schoolhouse, the kitchen, and the dairy, stables, carriage house, and workshops. Farther away were the cabins of the Negro slaves. Most of the slaves worked in the tobacco or rice fields during the long, hot summers. Some were house servants. Some worked in the shops making tobacco barrels and shoes, and spinning and weaving for the plantation.

The rivers were the chief highways in the South. Ships from England came up the rivers to a planter's private dock. They brought fine clothes, silver, china, and books, and carried away rice and tobacco for English buyers. Sometimes they brought a private teacher for the planter's children. Sometimes they carried the planter's older sons to school in England. The plantations were so widely scattered that it was not easy to have public schools. The dancing master and the music teacher came to give lessons at the great house. Guests often came from distant plantations to dances. Many of the young men sent abroad to school stayed on to go to universities there. Others came back to America to finish their education at the College of William and Mary in Virginia.

The coming of a ship was a big event.

Colonial children liked many of the same games that children play today. They liked to play ball and bat, shuffleboard, and tag, to shoot marbles, and to bowl on the grass. In spring and autumn they liked to go to town or county fairs. There they saw exhibits of fruits and vegetables, horses, cattle, and hogs. They watched horse racing, puppet shows, and ropewalking. One thing colonial children disliked—and no wonder—was taking big spoonfuls of medicine made of wine mixed with herbs and perhaps earthworms or even powdered toads. (See CANDLE; CLOTHING; MONEY; PILGRIMS; SCHOOLS; SMITH, JOHN; SOAP.)

COLOR No one could see the rose in the right-hand picture at the bottom of the page if there weren't any light shining on the picture. Light has to shine on the picture and then bounce up to our eyes. Then why are the petals red and the leaves green? Since it is just sunlight or artificial light that reaches our eyes, why isn't everything the same color?

To understand color one has to know that sunlight is made of many colors. A rainbow shows the colors in sunlight. Tiny drops of water in the air cause a rainbow by breaking up sunlight into the colors it is made of. So does a prism. The diagram at the left shows a prism breaking up light from the sun. Most artificial light is very much like sunlight.

When sunlight falls on the picture of the rose, the flower does not reflect all the sunlight. The ink used for the petals soaks up, or absorbs, most of the colors in the sunlight that strikes it. But it does not soak up the red rays. It reflects them to our eyes. The petals look red because the red rays reach our eyes.

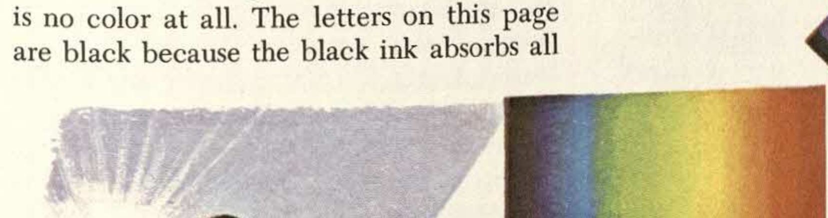
The leaves soak up the red rays and most of the other colors in sunlight. But they do not absorb the green rays. They reflect them to our eyes. The leaves therefore look green. The color of anything we see depends on the rays of light that it sends to our eyes.

White is a mixture of all the colors in the rainbow. The paper of this page looks white because it sends back to our eyes all the colors in the light that reaches it. Black is no color at all. The letters on this page are black because the black ink absorbs all the colors that strike it. The letters would not show if the paper around them did not reflect light to our eyes.

There are special lamps that do not give off white light like sunlight. A mercury vapor lamp, for instance, gives off light with no red rays in it. A person looks very unhealthy in the light of a mercury vapor lamp. His lips are purple and his cheeks bluish because no red rays are reaching them to be reflected. Some lamps send out only red rays. In the light of such a lamp the petals of the rose would still look red. But the leaves could not look green. No green light would reach them to be reflected. They would therefore look black.

Using a prism is not the only way of showing that white light is made up of all the colors of the rainbow. If a disk made up of the rainbow colors is whirled around very fast, the separate colors do not show. The eye puts them all together. The disk looks white.

Mixing colors by spinning a disk is not the same as mixing paints. With paint the primary colors from which you mix all others are red, yellow, and blue. Mixing yellow and blue makes green. With light the primary colors are red, blue, and green. Red and green are put together to make yellow. All the different colors we see on our color television screens and in color photographs come from mixing the primary colors of light—red, blue, and green. (See LIGHT; RAINBOW; SKY.)



COLORADO The state of Colorado was named for a mighty river which is bordered by reddish stone cliffs. Long ago, Spanish explorers named that river the Colorado. The name means "reddish."

The state song is "Where the Columbines Grow." As you see, columbine is the state flower. The blue spruce is the state tree. *Nil sine Numine,* Colorado's motto, means "Nothing without Providence."

Only seven states are larger than Colorado. This big, very wide state straddles the widest part of the great Rocky Mountains. Very high ranges in the Rockies run north and south in central Colorado. The western part of the state is a rough, dry plateau. Eastern Colorado is in the Great Plains. It, too, gets little rain.

The Rockies in Colorado form part of the Great Divide between rivers that flow to the Atlantic and those that flow to the Pacific. Among the Atlantic rivers that rise in Colorado are the South Platte, the Arkansas, and the Rio Grande. The Colorado is a Pacific river.

Colorado became a state in 1876, a hundred years after the Declaration of Independence. For a good reason, then, one of its nicknames is "Centennial State."

The United States bought part of the land of Colorado from France, in the Louisiana Purchase of 1803, and part of it from Spain in 1848. But American pioneers were in no hurry to settle in that land until after men found gold in it late in the 1850's. Then many settlers came in the "Race for the Rockies" and the Pikes Peak gold rush. By 1860, Denver, now Colorado's "mile-high" capital, was a small city. It grew even more after a railroad from the east reached the city in 1870. Today it is an airline center and has more than 500,000 people.

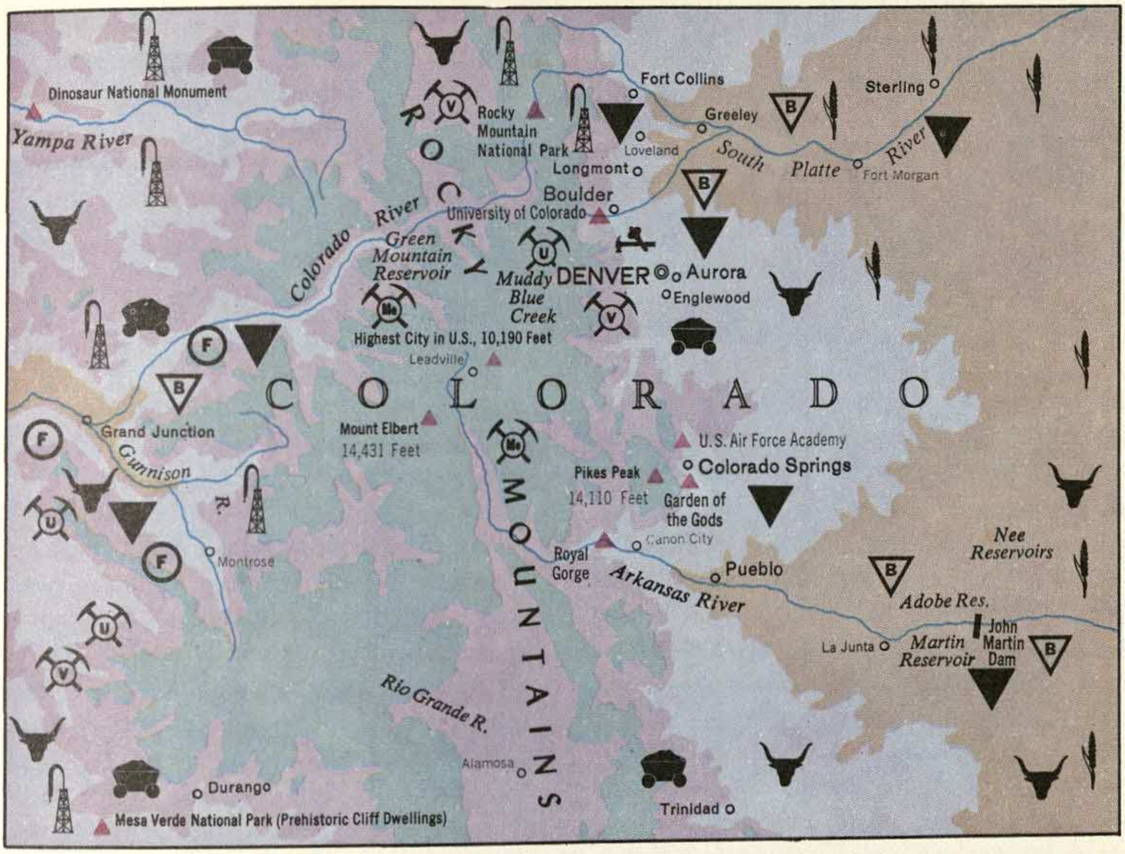
Another nickname for Colorado is "Silver State." Colorado's mines produce much silver—more than two million ounces a year. They also produce many other metals—gold, copper, lead, zinc, uranium, and molybdenum. The world's largest molybdenum mine is at Climax, a town not far from Leadville. The state has an enormous amount of brown coal, or lignite. It has many oil wells, too. And its deposits of oil shale are the richest in the world. Colorado, as you can easily understand, is well known for its great mineral wealth.

In spite of its light rainfall, Colorado is an important farming state. It has cattle ranches and dairy farms. It also has farms on which grains, vegetables, sugar beets, and fruits are raised. Colorado potatoes and Rocky Ford melons are famous. So are the cherries, apples, and peaches from the orchards of mountain farmers. Irrigation in many places makes big crops possible. California and Texas are the only states which have more irrigated land than Colorado. More than two and a half million acres are under irrigation.

Factories and mills employ many people. Denver is a great meat-packing center. Much mining machinery is made there, too. From tons of sugar beets, refiners make sugar. Pueblo has big steel mills.

Each year thousands of visitors spend vacations in Colorado. Rocky Mountain National Park has been called America's favorite playground. The Garden of the Gods has rocks carved by water and wind into fantastic shapes. In Mesa Verde National Park, the prehistoric homes of cliff dwellers can be seen. And there are many scattered wonders, such as great dunes, deep gorges, and Pikes Peak. That peak is one of 56 Colorado peaks more than 14,000 feet high. Mountain climbing, fishing, big game hunting, and skiing are among the many attractions of this scenic state. In a recent season nearly 400,000 visitors came for the skiing alone.

The bridge over the Royal Gorge, through which the Arkansas River flows, is one of the man-made wonders of the state. It is 1,000 feet above the railroad which runs beside the river. This bridge is the highest suspension bridge in the world. It carries automobile traffic across the gorge.



- (U) Uranium
- (V) Vanadium
- (Mo) Molybdenum
- Beef Cattle
- Coal
- (F) Fruit
- ▼ Garden Crops
- Wheat
- Hardware
- Oil
- (B) Sugar Beets

ELEVATION
Feet
Over 10000
7000 — 10000
5000 — 7000
3000 — 5000

▲ Historical Sites and Points of Interest

Total state population. . 1,977,000
Area (square miles). . . . 104,247

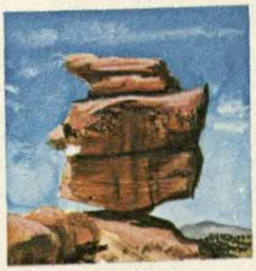
0 MILES 100

State Flower: Columbine

State Bird: Lark Bunting

Great Sand Dunes

Garden of the Gods



Mesa Verde

COLUMBUS, CHRISTOPHER (1451–1506) It was Friday, the 3rd of August, 1492. Three small ships set sail from Palos in Spain. They were the "Santa María," the "Pinta," and the "Niña." About 120 men were on board. The ships were on their way over an unmapped sea to find a new route to the Far East. Their commander was Christopher Columbus.

Columbus was born in Genoa, Italy, a city of seafarers. By the time he was 30 he had gone to sea many times. On one voyage he had sailed as far as Iceland.

In those days every nation in Europe wanted to find a short trade route to the Far East. Spices and silk and jewels had to be carried, mostly over long land routes, from Asia to Europe. Perhaps a shorter and easier route by sea could be found.

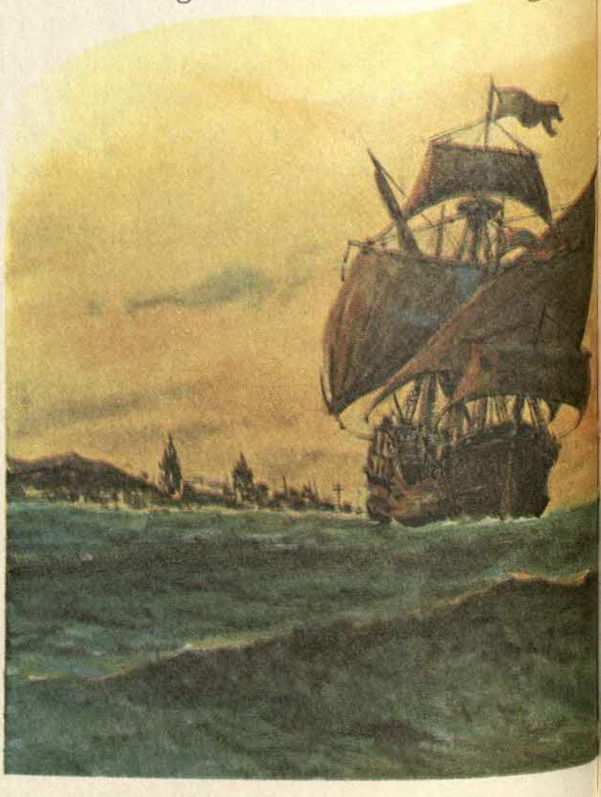
No one knows exactly when Columbus first had the idea of sailing west to find the Far East. But at least by the time he was 30 he was eager to try out this idea. Along with many people of his time, Columbus was sure that the earth is round. Since the earth is round, he thought, and since Asia stretches so very far eastward, it must curve a large part of the way around the earth. China, Japan, and the Indies, he argued, could not be very far to the west. He did not guess how big the earth is.

Columbus first asked the king of Portugal for men and ships. The king said no. He favored finding a way around Africa.

Then Columbus went to King Ferdinand and Queen Isabella of Spain. They were interested, but they thought that Columbus wanted too much reward if he were successful. He wanted to be made a Spanish nobleman and the governor of any lands he discovered. He wanted the title "Grand Admiral of the Ocean." He also wanted a tenth of all the riches he brought back. At first the Spanish rulers, too, said no. But as Columbus was on his way to ask help from the king of France, they changed their minds and gave him the ships he asked for.

After leaving Palos, the little ships sailed to the Canary Islands. From there, on September 6, they headed due west into unknown waters. The winds blew steadily and pushed them on their way.

For weeks the ships sailed westward. The crew grew restless. Never before had they been out of sight of land for such a long



time. Columbus is said to have cheered them on by crying *"Adelante! Adelante!"* ("Sail on! Sail on!")

Soon, however, there was danger of mutiny. But once again he persuaded the men to sail on. On October 11 several objects floated by. Then, just two hours past midnight, land was sighted. At daybreak on October 12 the party landed on an island which Columbus named San Salvador. It is in the group now called the Bahamas.

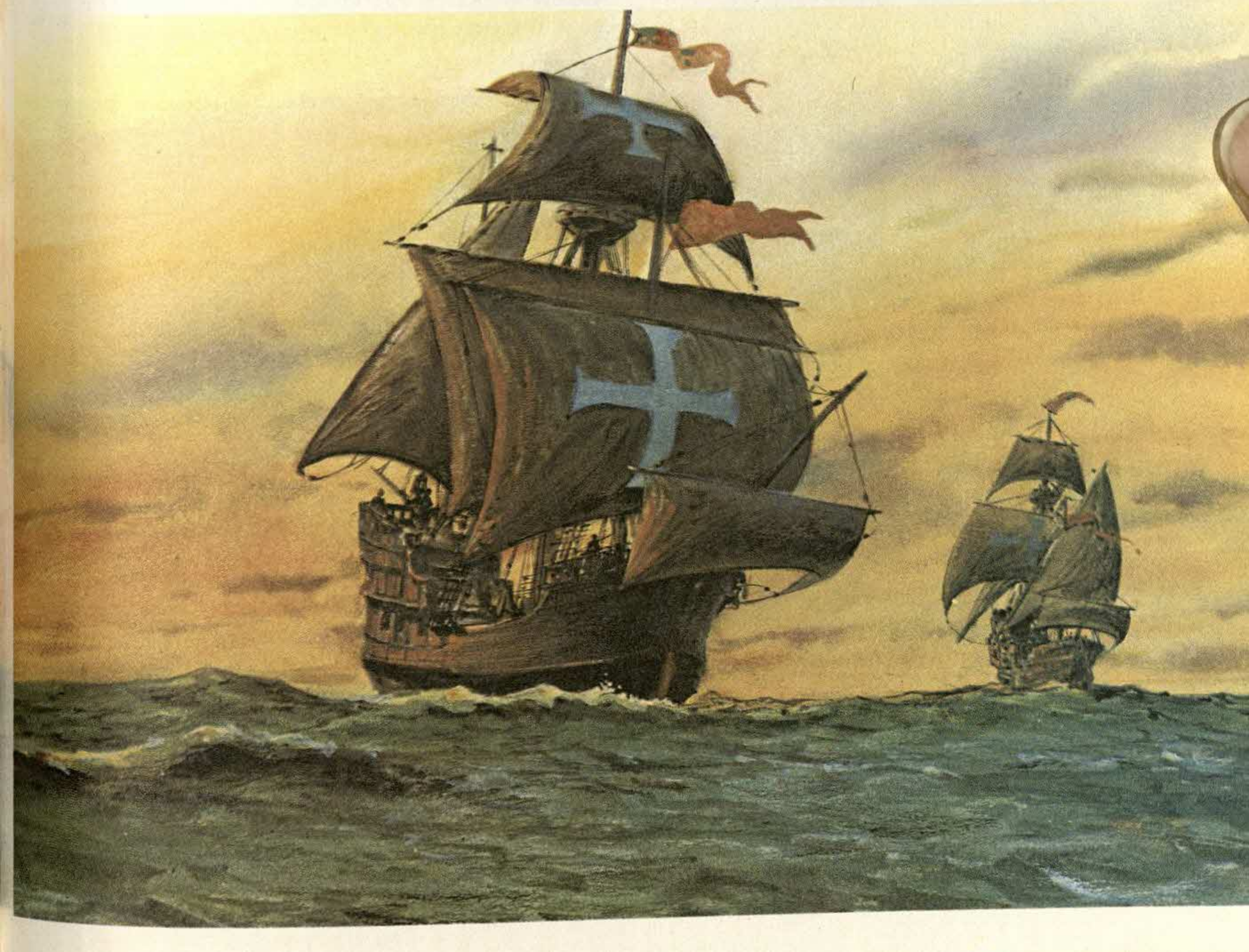
Columbus sailed from island to island. He was disappointed that instead of great, rich cities there were only a few villages. Dark-skinned people lived in them. Since Columbus thought he had reached the Indies, he called the natives Indians. After two or three months of sailing among the islands, Columbus returned to Spain.

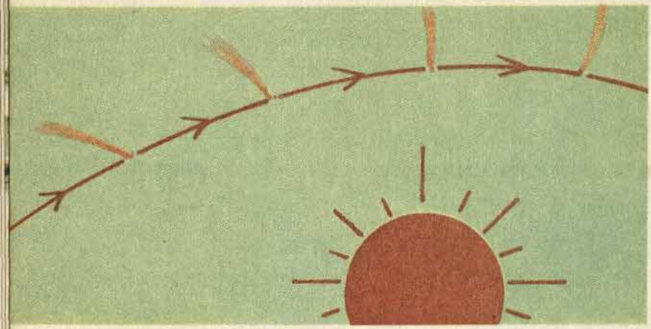
The rulers of Spain were excited. In a short time Columbus was on his way back with 17 ships and over 1,000 men. But again he found only islands, and he proved to be a poor governor of them.

On Columbus' third voyage to the New World, he reached the coast of South America. But he thought it was just another island. This time he was replaced as governor and taken back to Spain in chains.

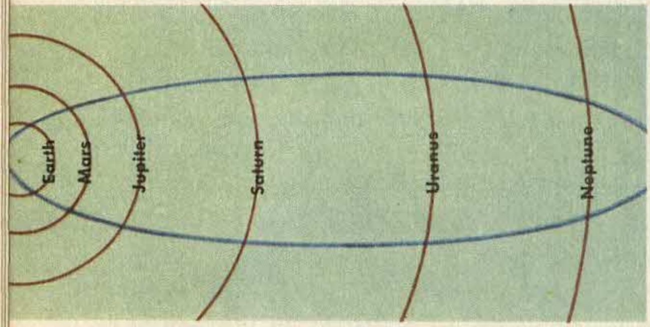
The king and queen overlooked his poor governing and honored him. They even let him make another trip to the New World. Still he brought back no riches. He died believing that America was only a group of islands on the way to the Asian mainland.

We know now that Columbus and his men were not the first Europeans to reach America. Norsemen and perhaps others had sailed to North America centuries earlier. But little was known about such early journeys till long afterward. Almost all Europe knew about the voyages of Columbus soon after they were over. He became famous for discovering America.





A comet's tail is formed as it nears the sun.



The very long orbit of Halley's comet cuts across the paths of the planets.

COMET The sun has a whole family of heavenly bodies traveling around it. Some of the most interesting are the comets. "Comet" comes from a Latin word that means "hair." A comet looks like a star with shining hair streaming out from it.

There are hundreds of comets traveling around the sun, but many people live all their lives without ever seeing one. Most comets do not come close enough to the earth to be seen without a telescope.

People of long ago were very much frightened when there was a comet bright enough to be seen. They thought it was a sign that something terrible was about to happen. Today people have given up that old idea.

Comets have paths, or orbits, around the sun, but they are not the shape of planet orbits. Halley's comet has a typical path. The paths of many comets cross the earth's orbit. Someday the earth may have a head-on collision with a comet. It has already gone through the tail of one. This happened

Halley's comet, expected every 76 years, last appeared in 1910.

on May 18, 1910. Newspapers carried the news in advance. Many people feared the world would end. But nothing happened at all. If the news had not been in the papers, few people would have known that the earth had had a strange adventure.

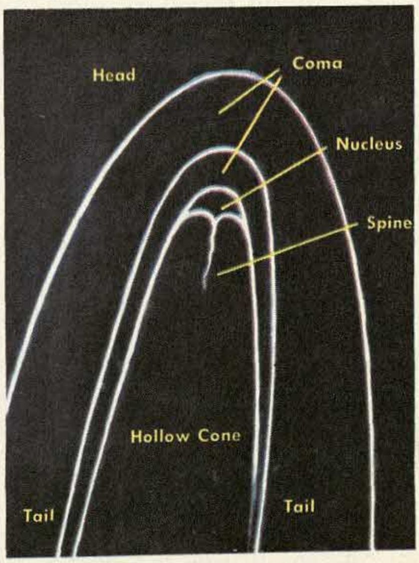
No one knows what would happen if the earth ran into the head of a comet. The head of a comet is very big—much larger than the earth—but it is not a solid ball. Instead, it is made up mostly of tiny particles of rock. It has within it, however, a solid body called a nucleus, usually only a mile or so across.

When a comet is far away from the sun, it does not have a tail. But when a comet comes close to the sun, the light of the sun drives out gas and fine dust from the head. The gas and dust form a shining tail. A comet's tail always streams away from the sun even when the comet is retreating.

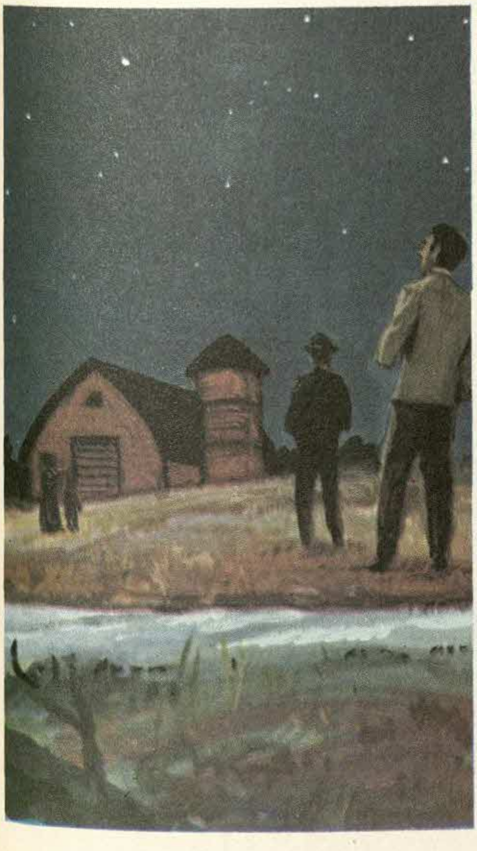
Halley's comet is the best-known comet. It was named for Edmund Halley, a famous English astronomer. Halley's comet comes close to the earth every 76 years. It was through the tail of this comet that the earth passed in 1910. It is due to appear next in 1986. This same comet was seen during the Crusades, when the Christians were fighting the Turks. One of the Christians' prayers was, "Lord, save us from the Devil, the Turk, and the Comet."

Sometimes a comet goes too close to the sun or a large planet and is pulled to pieces. Nothing is left of it but bits of rock. (See ASTRONOMY; METEORS AND METEORITES; SOLAR SYSTEM.)

The Parts of a Comet



A comet's head, or coma, is formed mostly of small, widely spaced rock particles. The nucleus is a solid body, made perhaps partly of ice. The tail is a stream of gas and very fine dust. A comet gives off no light of its own.



1910
Halley's Comet

1861
Great Comet

1908
Morehouse's Comet

COMMUNICATION A person often wishes to ask a question of someone else or share an idea. We are all eager to get news of what is going on in the world. Passing along questions, information, ideas, and news is called communication.

Making gestures and talking were early ways of communicating. Later, men learned to draw pictures, write, and, much later, print. They learned to send signals with drums, smoke, bells, flags, and mirrors.

During the past 125 years many new ways of communicating have been invented—motion pictures, the telegraph, the telephone, radio, and television. Message cables cross the oceans. Satellites are helping to put every part of the world into close touch with every other part. The changes in the 20th century have had such far-reaching effects that they are spoken of as the Communications Revolution.

Telstar Satellite

COMMUNISM In the United States many people own their own homes, farms, and businesses. Everyone is free to choose the kind of work he wants to do. In communist countries things are quite different. Under communism, the state owns all the land and runs all the businesses. The goal is for no one to be rich and no one poor. All are supposed to work and share equally.

The term "communism" came into common use only a little more than 100 years ago, after *The Communist Manifesto* was written by Karl Marx and Friedrich Engels of Germany. The first country to be ruled by a communist government was the Soviet Union. Under the leadership of Nikolai Lenin and others, Communists took control of the country by force in the Bolshevik Revolution of 1917.

To many people, communism sounds like a pleasant way of living. The Soviet Union and Communist China have certainly made great advances in science and industry. But life has by no means been entirely pleasant in any country practicing communism. Communist rulers often have enforced their rule harshly. The people have had very little freedom. They have been told not only what work they must do but also what they should think, study, and believe.

People who believe in communism are often called "Reds," because red is the main color in Communist flags. Because of the lack of freedom in Communist countries "Communist" and "Red" are dreaded words to many. (See CHINA; SOCIALISM; UNION OF SOVIET SOCIALIST REPUBLICS.)

Early sailors had no compasses.

COMPASS, MAGNETIC For hundreds of years after men had boats they still did not dare go far out to sea. They had no way of telling directions when it was so cloudy that they could not see the sun or the stars.

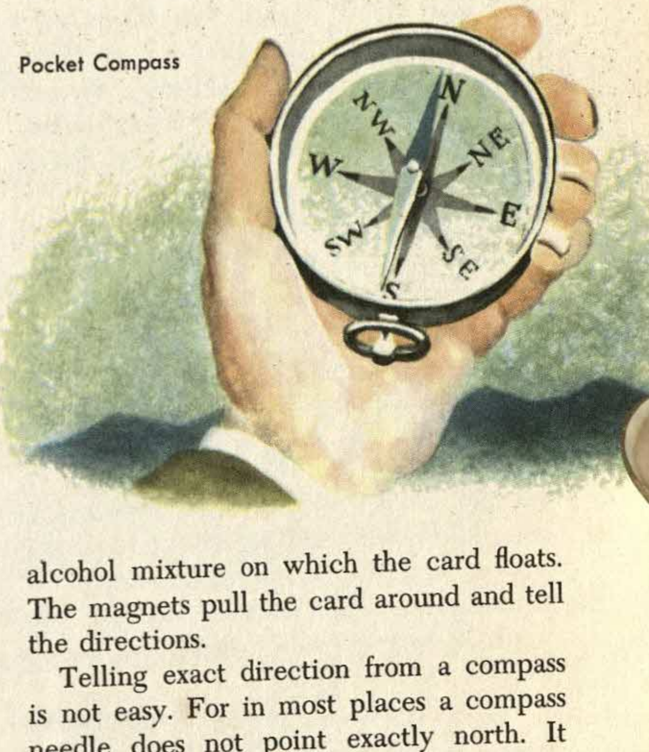
The Vikings were among the earliest to venture far from land. They could find their way even on cloudy days, their legends say, by using magical "sun stones." Scientists have now found what may be a clue as to what these sun stones were. A mineral found in Viking lands changes color when held in line with the sun even when the sun is under a cloud. When the great age of exploring began some 500 years ago, sailors had something better than sun stones to guide them—magnetic compasses. Their compasses were small magnets arranged so that they could turn easily.

A magnetic compass tells direction because the earth acts as a magnet. Its magnetic force pulls the compass magnet, or needle, into a north-south position.

Early Marine Compass

Some of the early compasses were little pieces of lodestone resting on small pieces of wood or cork which floated in bowls of water. Lodestone is a kind of iron ore. Another name for it is magnetite. Pieces of this ore are natural magnets. After men learned to make magnets of steel, they could make better compasses.

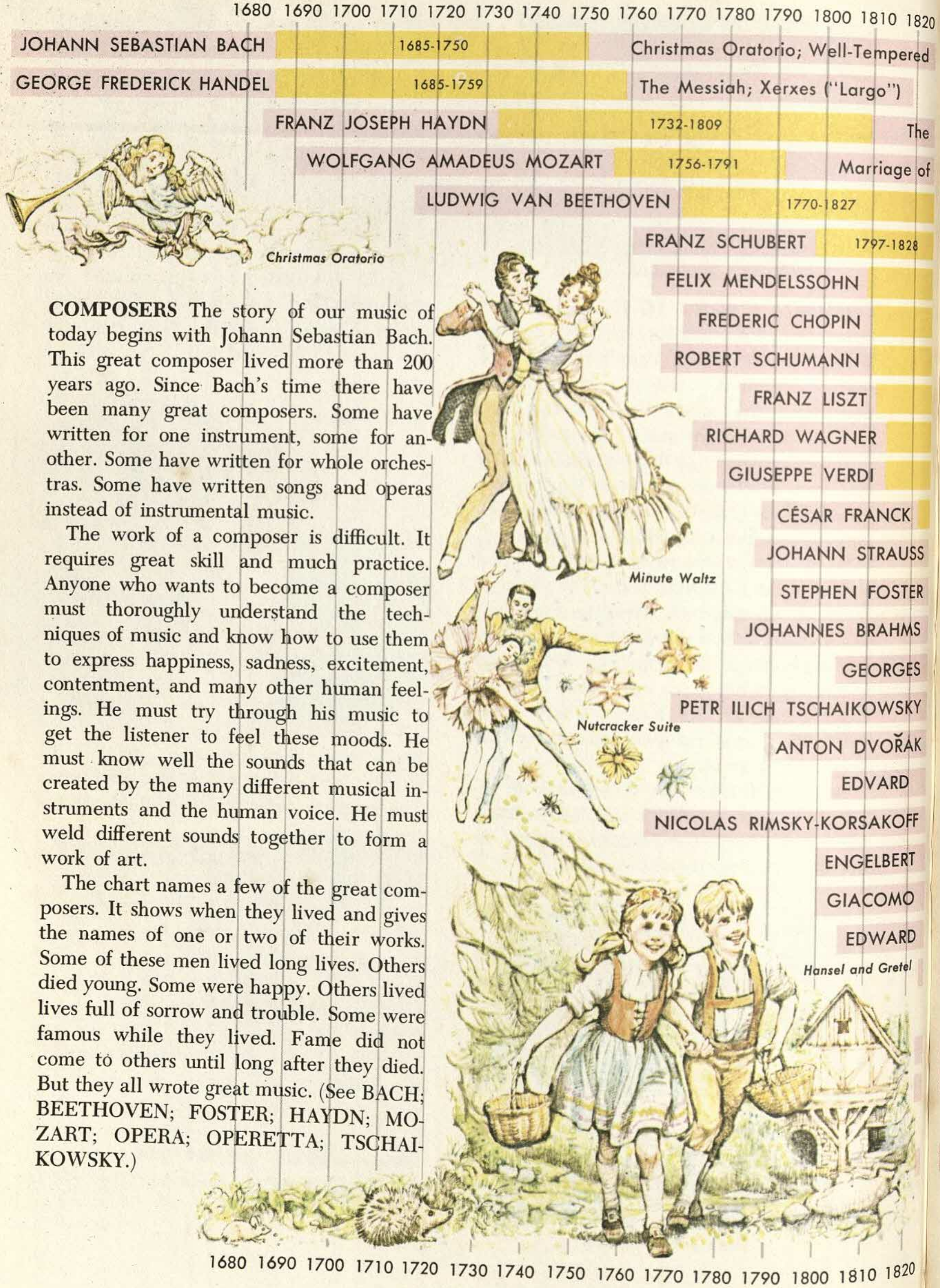
Modern magnetic ship compasses are usually made of several magnets fastened to a flat disk called a compass card. The card is mounted so that it can swing around freely. The card and the pivot are in a glass-covered bowl usually filled with an alcohol mixture on which the card floats. The magnets pull the card around and tell the directions.



Pocket Compass

Telling exact direction from a compass is not easy. For in most places a compass needle does not point exactly north. It points to the north *magnetic* pole, which is several hundred miles from the true North Pole. Charts help sailors correct their compass readings so that they can tell true north.

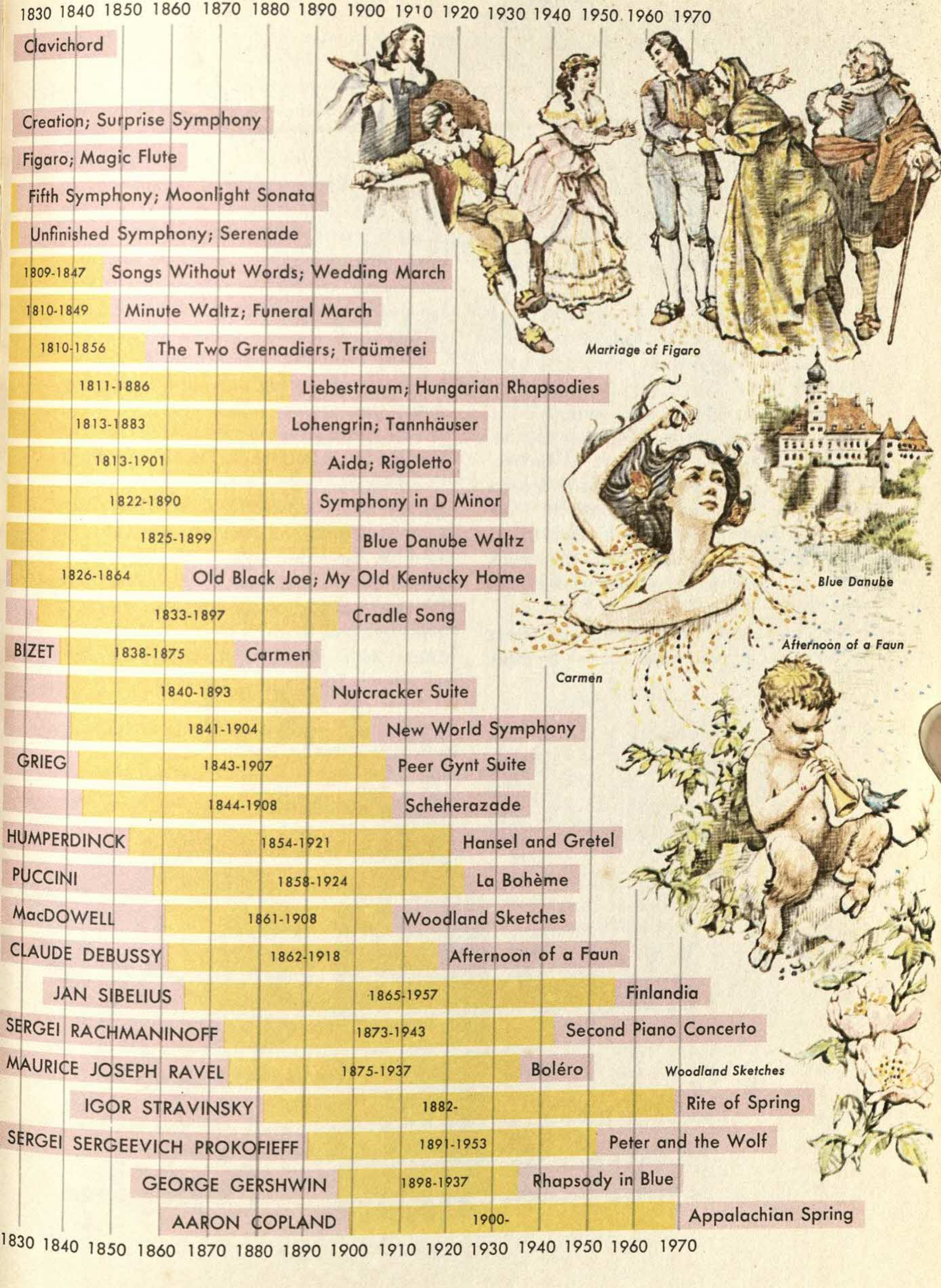
In most big boats of today another kind of compass is also used. It is a gyroscope compass, or gyrocompass. A compass much like it is used in airplanes. Radio and navigation satellites also help the pilots and sailors of today tell direction. (See GYROSCOPE; MAGNETS.)



COMPOSERS The story of our music of today begins with Johann Sebastian Bach. This great composer lived more than 200 years ago. Since Bach's time there have been many great composers. Some have written for one instrument, some for another. Some have written for whole orchestras. Some have written songs and operas instead of instrumental music.

The work of a composer is difficult. It requires great skill and much practice. Anyone who wants to become a composer must thoroughly understand the techniques of music and know how to use them to express happiness, sadness, excitement, contentment, and many other human feelings. He must try through his music to get the listener to feel these moods. He must know well the sounds that can be created by the many different musical instruments and the human voice. He must weld different sounds together to form a work of art.

The chart names a few of the great composers. It shows when they lived and gives the names of one or two of their works. Some of these men lived long lives. Others died young. Some were happy. Others lived lives full of sorrow and trouble. Some were famous while they lived. Fame did not come to others until long after they died. But they all wrote great music. (See BACH; BEETHOVEN; FOSTER; HAYDN; MOZART; OPERA; OPERETTA; TSCHAIKOWSKY.)



		Clavichord
		Creation; Surprise Symphony
		Figaro; Magic Flute
		Fifth Symphony; Moonlight Sonata
		Unfinished Symphony; Serenade
	1809-1847	Songs Without Words; Wedding March
	1810-1849	Minute Waltz; Funeral March
	1810-1856	The Two Grenadiers; Traümerei
	1811-1886	Liebestraum; Hungarian Rhapsodies
	1813-1883	Lohengrin; Tannhäuser
	1813-1901	Aida; Rigoletto
	1822-1890	Symphony in D Minor
	1825-1899	Blue Danube Waltz
	1826-1864	Old Black Joe; My Old Kentucky Home
	1833-1897	Cradle Song
BIZET	1838-1875	Carmen
	1840-1893	Nutcracker Suite
	1841-1904	New World Symphony
GRIEG	1843-1907	Peer Gynt Suite
	1844-1908	Scheherazade
HUMPERDINCK	1854-1921	Hansel and Gretel
PUCCINI	1858-1924	La Bohème
MacDOWELL	1861-1908	Woodland Sketches
CLAUDE DEBUSSY	1862-1918	Afternoon of a Faun
JAN SIBELIUS	1865-1957	Finlandia
SERGEI RACHMANINOFF	1873-1943	Second Piano Concerto
MAURICE JOSEPH RAVEL	1875-1937	Boléro
IGOR STRAVINSKY	1882-	Rite of Spring
SERGEI SERGEEVICH PROKOFIEFF	1891-1953	Peter and the Wolf
GEORGE GERSHWIN	1898-1937	Rhapsody in Blue
AARON COPLAND	1900-	Appalachian Spring

COMPOUNDS Just a list of all the substances in the world would take many books the size of this one. And all of these substances are made up of only about 100 simple substances called elements. Most of the millions of substances are compounds or mixtures. A compound is made of two or more elements joined together chemically. Air and milk are good examples of mixtures. Water and sugar are good examples of compounds.

No one can tell just by looking at a compound what is in it. Water is made up of hydrogen and oxygen. They are both colorless gases! Sugar is even more surprising. It has oxygen and hydrogen in it just as water has. It has carbon in it, too. Carbon is usually black. Soot is carbon. Carbon is not sweet. Neither is hydrogen or oxygen. But sugar, of course, is. Now that you know what sugar is made of, it will not surprise you to see sugar turn black when it scorches. The carbon has come out of hiding.

In a compound the elements are always in the same proportion. There can be more than one compound of the same elements. And different compounds of the same elements may be very different. Carbon dioxide is one of the gases in the air. It is harmless. In fact, plants could not grow and make food for us if there weren't any carbon dioxide in the air. The smallest bit of an element is an atom. Carbon dioxide is made up of two atoms of oxygen for every atom of carbon. Carbon monoxide is made up of carbon and oxygen, too. But it has only one atom of oxygen for each atom of carbon. It is a very poisonous gas.

Every compound has a formula—a shorthand way of writing its name. In the formulas the symbols scientists have worked out for the different elements are used. The formula for water is H_2O. The figure 2 shows that in water there are two atoms of hydrogen for every atom of oxygen. CO_2 is carbon dioxide. CO is carbon monoxide. The formula for cane sugar is $C_{12}H_{22}O_{11}$. It shows that in this kind of sugar there are 12 atoms of carbon for every 22 atoms of hydrogen and 11 of oxygen. You might guess that $C_6H_{10}O_5$ is the formula for some other

Mercuric Oxide
(Red Oxide of Mercury)

HgO

Sodium Chloride (Table Salt)

$NaCl$

CCl_4

Carbon Tetrachloride
(Cleaning Fluid)

Silicon Dioxide
(Quartz, or Sand)

SiO_2

Computers and Computer Learning Center

kind of sugar. Instead, it is the formula for the compound starch.

The picture shows four other compounds. They are salt, quartz, carbon tetrachloride, and red oxide of mercury.

Salt (NaCl) is made of sodium, a poisonous metal, and chlorine, a poisonous greenish gas. Salt is not at all like either element. It is not poisonous. In fact, our bodies have to have it to stay alive.

Quartz (SiO_2) is a very common compound—one of the commonest in the world. It is made of oxygen and silicon. Not many people have ever seen pure silicon. But almost everyone has seen this compound of silicon. For most grains of sand are tiny bits of quartz.

HgO is red oxide of mercury. Who would guess that this red powder is made of the silvery liquid metal mercury and the colorless gas oxygen? And who would guess that colorless carbon tetrachloride (CCI_4) is made of black carbon and greenish chlorine?

New compounds are being made every day. Elements are being joined in new ways. Finding new ways of making elements join together has given us some wonderful new materials. Among them are all the plastics. (See ATOMS; CHEMISTRY; ELEMENTS; MOLECULES.)

COMPUTER How long would it take you to multiply 24,683,579 by 97,538,642? Probably several minutes at least. An electronic computer could do this multiplication in a tiny fraction of a second. In five minutes a fast electronic computer can do more calculating than a person could do with pencil and paper in all his life.

Calculating machines have been used for a long time. The abacus, cash register, and common adding machine are calculating machines. Electronic computers are comparative newcomers. They are proving so helpful, however, that although very expensive many thousands are in use.

Adding up bills, handling payrolls, figuring interest, and keeping track of election returns are a few of the everyday uses of computers. But computers can handle much more than figures. They can handle facts, too, and they can be used to run other machines. They can put together weather statistics, keep track of planes and ships, land planes on aircraft carriers, control the progress of steel through a rolling mill, and much more. Space travel would be out of the question without them. New uses are being found for them every day, and many special-purpose computers are being built. Some are being used in teaching. The boy pictured on page 349 is getting help from a computer in learning to read.

Of course, electronic computers are complicated. Early ones had vacuum tubes and were huge. Then transistors took the place of vacuum tubes, and the computers could be smaller. Now miniaturized parts make it possible for them to be still smaller.

Computers are sometimes called electronic brains. Writers often joke about a time in the future when computers will do all our thinking for us. The idea is foolish. Computers cannot plan and build themselves. They cannot gather facts and figures. These must be fed into them. They can do nothing with these facts and figures they are not built to do. But these machines are wonderful proof of how clever people are at working out ways of helping themselves. (See ELECTRONICS.)

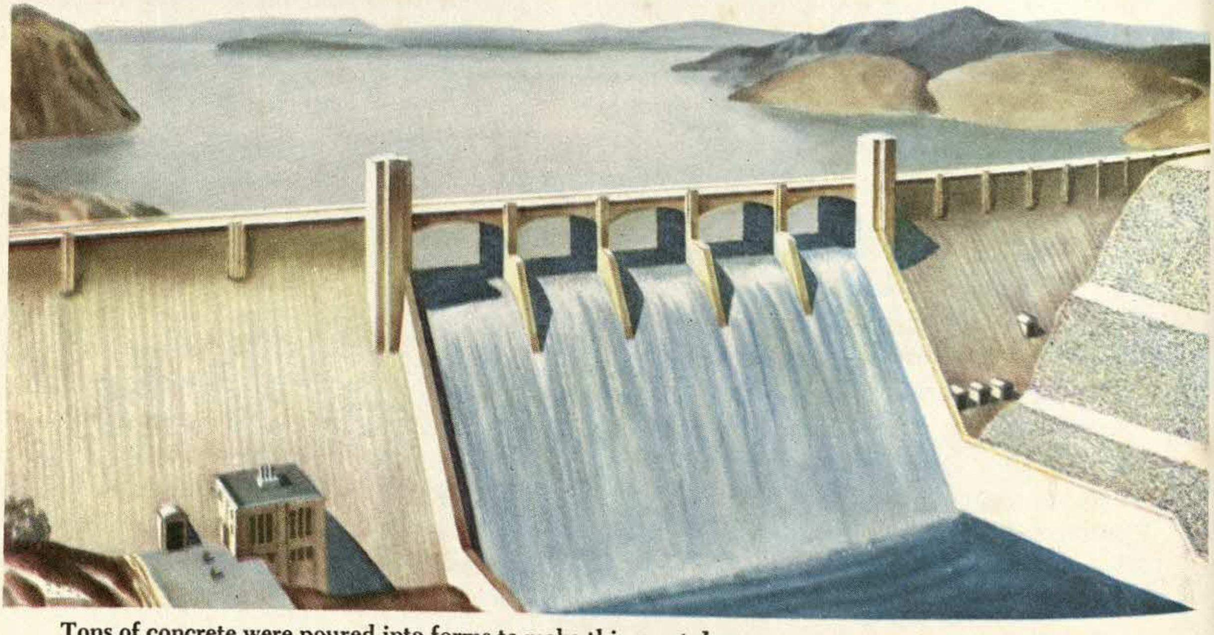
CONCRETE Many great bridges and dams are made of concrete. So are thousands of miles of roads and sidewalks and runways. There are concrete floors, stairways, and foundations, as well as whole buildings of concrete. Thick walls of concrete shield atomic reactors. The launch pads for rockets are also built of concrete.

Cement, water, sand, and crushed rock or gravel are mixed together to make ordinary concrete. Usually big machines do the mixing. The rock "batter" is then poured into molds, or forms, which give the concrete the shape wanted. When the concrete hardens, the forms are taken away. A wall or walk or dam can be made with concrete in much less time than with bricks or stone.

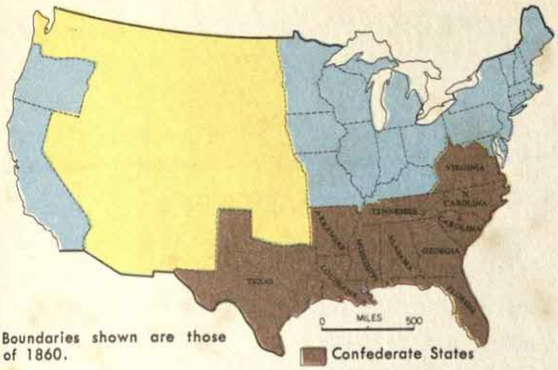
Concrete can also be made into blocks and then built into buildings. Walls, floors, and roof sections can be cast ahead of time in factories. Buildings made with them go up amazingly fast.

There are special kinds of concrete for special uses. Sometimes steel rods are run through it. Then it is called reinforced concrete. Concrete floors may have asphalt added so that they will be more comfortable to stand on. For lightweight concrete such materials as pumice and vermiculite are used in place of sand and gravel. Some concretes are light enough to float on water.

Concrete is strong, and it lasts well. It will not burn. Termites and borers cannot eat it. And concrete is cheap, compared to many other materials. It is easy to see why it is popular. (See BRIDGES; BUILDING MATERIALS; DAMS.)



Tons of concrete were poured into forms to make this great dam.



Boundaries shown are those of 1860.

CONFEDERATE STATES In 1860 there were 33 states in the United States. But in December of that year South Carolina withdrew, or seceded, from the Union. In the first months of 1861, 10 more southern states seceded. They were Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Tennessee, Texas, and Virginia. These states formed the Confederate States of America. They chose Jefferson Davis as their president and Richmond, Va., as their permanent capital.

These southern states wanted to set up a government of their own because they did not agree with the northern states about a number of things. One of the big disagreements was about slavery. The South thought that it could not do without slaves. The North was against slavery.

The bitter Civil War was fought between the North and the South. The Confederate States lost. They became once more a part of the United States of America. (See EMANCIPATION PROCLAMATION; LEE, ROBERT E.; LINCOLN, ABRAHAM; MASON AND DIXON'S LINE; MONITOR AND MERRIMAC; SLAVERY.)

CONFUCIUS (551–479 B.C.) Twenty-five hundred years ago life in China was very hard. Robbers roamed the countryside. The government was weak and often unjust. Most of the people were hopelessly poor. Into these times one of China's great leaders was born. His family name was K'ung. We call him Confucius, a Latin form of K'ung Fu-tzu, which means "Master K'ung."

Confucius came from a noble family, but his parents were poor. The boy was a good and obedient son. He grew up to be quiet, thoughtful, and studious.

Confucius, seeing how the people around him were suffering, wished to help them. He started out to teach others how to live better lives. He taught his pupils to be honest and kind, to honor their parents, and to obey their rulers. He taught them, too, that it was the duty of parents to love their children, and of those who ruled to think of the welfare of their subjects rather than of their own pleasure.

Many of Confucius' sayings were gathered together and written down. They are somewhat like the proverbs in the Bible. One of his sayings is much like the Golden Rule. "Do not do to others," it says, "what you do not wish others to do to you."

Confucius longed for a chance to show that improving the government would make people happier. He did serve for a time as chief justice of a province. He soon realized, however, that the title carried no real authority. He gave it up and for years wandered from province to province spreading his ideas to all who would listen.

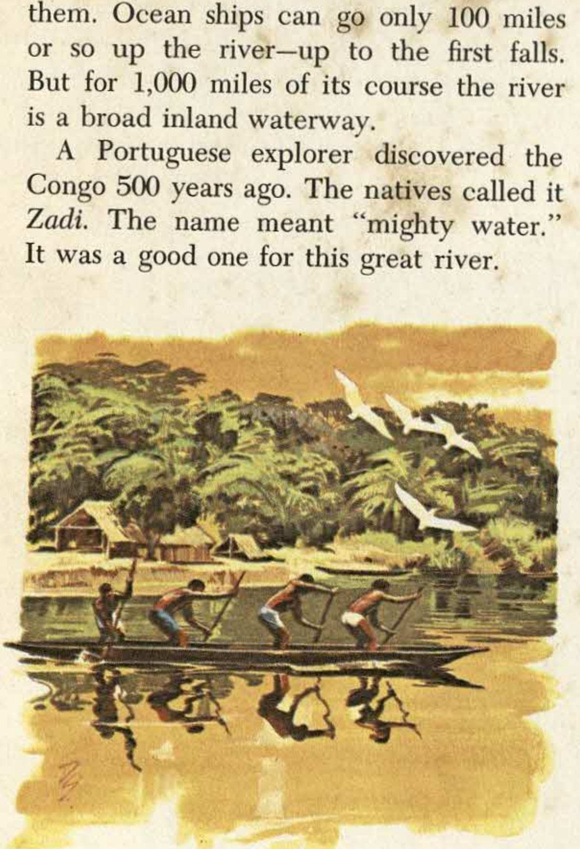
Confucius never pretended to be more than an ordinary man. But after he died great temples were built to him. His beliefs make up one of the world's great religions—Confucianism. There are over 300,000,000 followers of Confucius today. (See RELIGIONS OF THE WORLD.)

CONGO RIVER One of Africa's truly great rivers is the Congo. It is nearly 3,000 miles long. In places it is nine miles wide. In others it is narrow and flows through a deep gorge. On its way to the Atlantic it crosses the equator twice.

Traveling down this vast river is in many ways not at all like traveling down the Mississippi. These are some of the strange sights a traveler might see: hippopotamuses and crocodiles in the water; elephants in high grass near the banks; hot, gloomy forests with bright flowers, chattering monkeys, and screaming parrots; native tribesmen catching fish with long spears; huts made of grass and palm leaves; the blazing sun straight overhead at noon. Brazzaville and Kinshasa (formerly Léopoldville), the capitals of the two new Congo nations, are among the few cities on the Congo's banks.

On stretches of the Congo there are falls and rapids which boats cannot pass. Railroads have been built around some of them. Ocean ships can go only 100 miles or so up the river—up to the first falls. But for 1,000 miles of its course the river is a broad inland waterway.

A Portuguese explorer discovered the Congo 500 years ago. The natives called it *Zadi.* The name meant "mighty water." It was a good one for this great river.



CONIFERS At Christmastime conifers play a big part in our celebrations. For our Christmas trees are conifers.

"Conifer" means "cone bearer." Most conifers produce their seeds in cones. A few have berrylike fruits instead.

Scattered over the world are hundreds of kinds of conifers. Not all of them are trees. Some junipers, for instance, are bushes which grow close to the ground. But most conifers are trees. Among them are the giants of the plant world—the redwoods and big trees. Both are sequoias. Among them, too, are many of our most important timber trees.

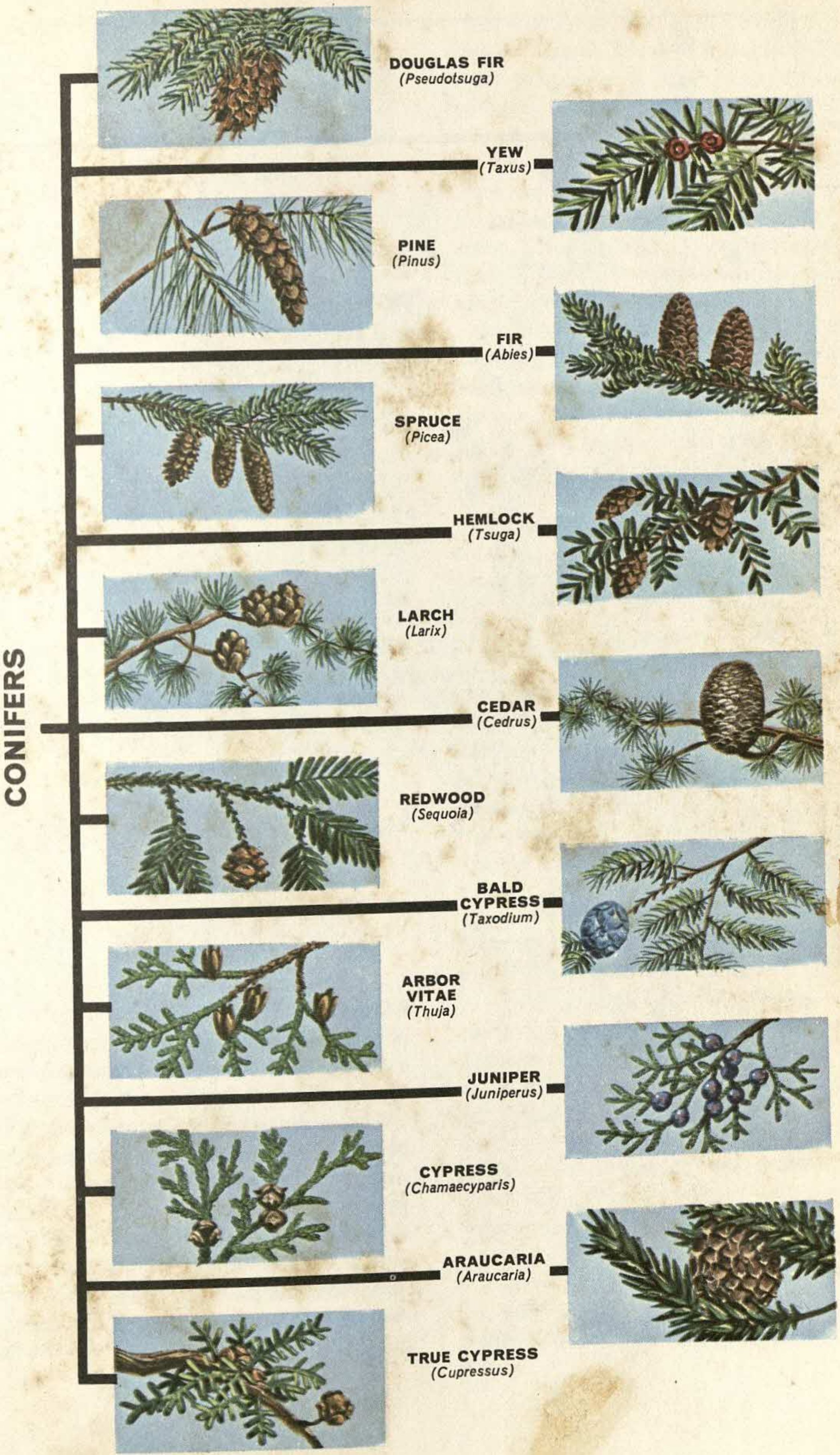
The chart on the next page shows 15 important groups of conifers. Some of these groups are not found in the United States. The araucarias, or Chile pines, are South American trees. We call some American conifers cedars, but all the true cedars are natives of the Old World.

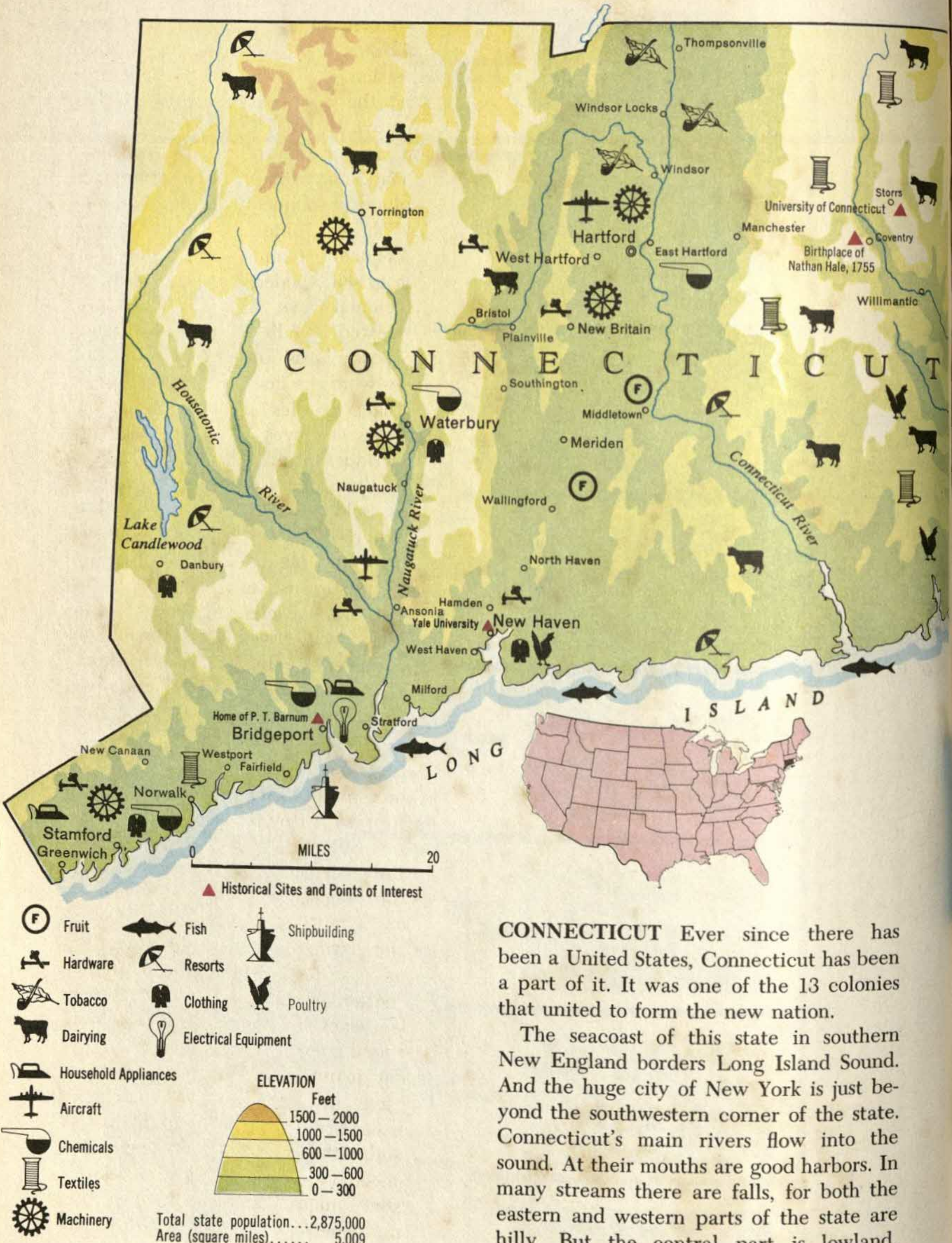
Most conifers are evergreens and do not drop their leaves when winter comes, as elms and maples do. But some conifers lose their leaves in the fall. The larches and the bald cypress, for example, are conifers, but they are not evergreens.

Some conifer leaves are scalelike and lap over one another. Others are so narrow they are called needles. The needles of different conifers are not alike. Some are short; others are long. Some are four-sided; others are flat. Some grow in bunches of two or more; others are not bunched. There are differences in color, too.

The evergreen conifers do not keep the same leaves all their lives. They keep losing old leaves a few at a time instead of losing all of them at one time in the fall.

Great conifer forests once covered a large part of the United States. Millions of trees have been cut for lumber. Millions more have been killed by forest fires. One of the country's problems now is how to keep its conifer forests from disappearing. (See CONSERVATION; FORESTS AND FORESTRY; LUMBERING; TREES.)

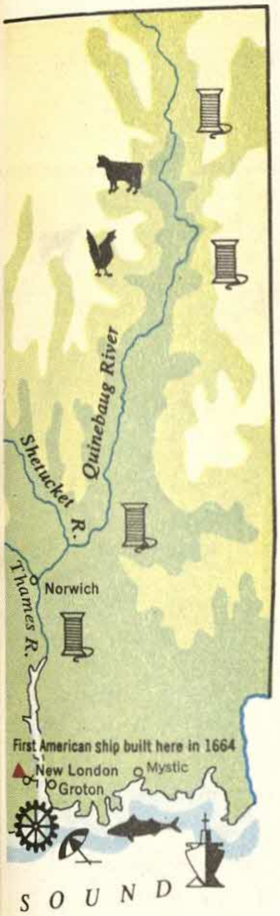

CONIFERS
DOUGLAS FIR
(Pseudotsuga)
YEW
(Taxus)
PINE
(Pinus)
FIR
(Abies)
SPRUCE
(Picea)
HEMLOCK
(Tsuga)
LARCH
(Larix)
CEDAR
(Cedrus)
REDWOOD
(Sequoia)
BALD CYPRESS
(Taxodium)
ARBOR VITAE
(Thuja)
JUNIPER
(Juniperus)
CYPRESS
(Chamaecyparis)
ARAUCARIA
(Araucaria)
TRUE CYPRESS
(Cupressus)



Total state population...2,875,000
Area (square miles)...... 5,009

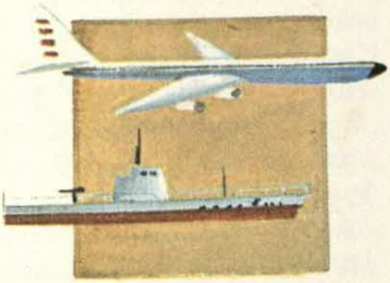
CONNECTICUT Ever since there has been a United States, Connecticut has been a part of it. It was one of the 13 colonies that united to form the new nation.

The seacoast of this state in southern New England borders Long Island Sound. And the huge city of New York is just beyond the southwestern corner of the state. Connecticut's main rivers flow into the sound. At their mouths are good harbors. In many streams there are falls, for both the eastern and western parts of the state are hilly. But the central part is lowland.



State Flower: Mountain Laurel

State Bird: Robin



And southward across it the long Connecticut River flows. In Indian language, the word *quinnitukqut,* from which "Connecticut" comes, means "at the long tidal river."

Although quite a few—25—have fewer people, only two states are smaller than Connecticut. The little state has a great many cities for its size, but only four of them have populations of over 100,000. The surrounding countryside has beautiful tree-covered hills, lowland and valley farms, and picturesque villages.

One nickname for Connecticut is "Constitution State." In 1639, people in three little settlements on the Connecticut River adopted the first constitution of its kind in America. Almost 150 years later, parts of the Constitution of the United States were made much like that constitution for the colony of Connecticut. Another nickname, "Nutmeg State," came from the idea that Connecticut merchants were sharp enough to sell wooden nutmegs.

In colonial days, many little factories were located at falls in the rivers, where water power was plentiful. Connecticut factories were the first in America to make men's hats, needles and pins, brass buttons, hooks and eyes, clocks and watches, coffee grinders, and cookbooks. Peddlers carrying these useful articles on wagons or in packs sold them throughout New England. Where little factories were built earlier, cities and big modern factories now stand. The state is famous for the manufacture of brass articles. Airplane construction ranks high. Even submarines using atomic power are built on Connecticut's coast. Things as different as carpets, silverware, firearms, and sewing machines now come from its factories.

Connecticut's capital and biggest city is Hartford. In that city there are the main offices of so many insurance companies that it is called a world insurance capital. Yale University in New Haven, Connecticut's third biggest city, is world famous.

About a fourth of Connecticut's land is used for farming. In the broad valleys farmers raise tobacco. They also produce milk, butter, eggs, poultry, and vegetables for themselves and the nearby cities. Much of the food goes to New York City.

Today many people who work in New York live in southwestern Connecticut. Expressways join Connecticut with New York and with the rest of New England.

Connecticut's Latin motto, *Qui transtulit sustinet,* means, "He who transplanted sustains." The state tree is the white oak.

Sandhill Crane, a Bird of the Marshes

CONSERVATION Some of the early settlers in America came to the region near the James River in Virginia. They cleared away the trees there and planted big fields of tobacco. Tobacco takes a great deal from the soil. Soon the land was no longer able to produce big tobacco crops. Then the settlers moved on to new land. There was plenty of it. The story of these planters has been told in just a few words: "Cut down, wear out, walk off."

When settlers first reached the Great Plains they found huge herds of bison, or buffaloes. There were so many bison that a hunter might take home for food only the tongues—the choicest meat—of most of the bison that he killed.

These are samples of the way early settlers wasted the riches they found in America. The wasting went on for more than 200 years. At last people began to see that it must be stopped, or in time there would be no riches left. They began to do something about conservation. Conservation means using without waste.

Soil and wildlife are only two of the natural riches Americans wasted. Among the others are forests, water, and minerals such as coal and oil.

Americans have wasted soil in two ways. They have worn it out just as the early Virginia planters did. They have also let it be washed away. The Mississippi River alone carries several hundred million tons of soil a year and dumps it in the sea. Water running into streams after heavy rains makes gullies that can ruin good farmland.

The bison is only one of the wild animals that have been killed in enormous numbers. Some kinds of animals have been entirely killed off.

The nine animals pictured on the next page have disappeared, or become extinct, in modern times. And people are to blame. All these animals except the quagga and the dodo were natives of North America.

Hunters killed great numbers of these animals to get food, fur, or feathers. Some they killed just for sport. They killed the grizzly partly because they were afraid of it. Hunters, however, are not entirely to blame for the fact that there are fewer and fewer wild animals each year. People have taken away homes of wild animals. They have cut down forests and plowed up grasslands. They have drained marshes which served as homes for water birds. They have made lakes and streams unfit for fish by dumping wastes into them.

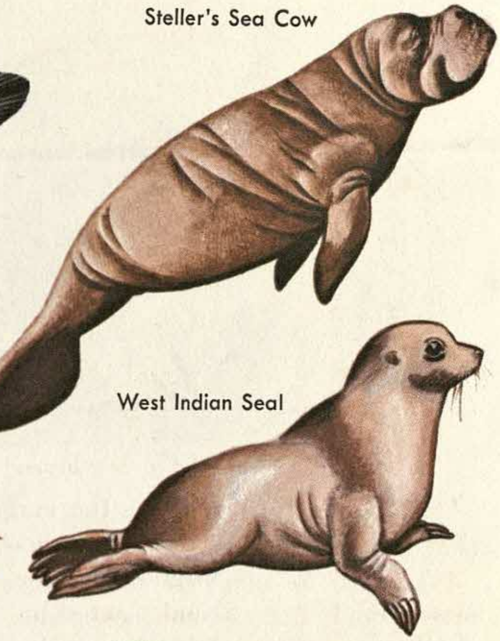
The early settlers had to cut down trees to clear land for farming. People have kept on cutting down trees so fast that virgin forests—forests from which no trees have been cut—are almost gone. Of course, trees that are made into houses, furniture, and other useful things are not wasted. But Americans have destroyed many trees needlessly, partly by starting forest fires.

Passenger Pigeon

Labrador Duck

Eskimo Curlew

Quagga



Steller's Sea Cow

West Indian Seal

California Grizzly

Great Auk

Dodo

Heath Hen

Water covers nearly three-fourths of the earth. It is hard to believe that anyone has to think of saving it. But much of the earth's water is salty. In many places fresh water is scarce. By cutting down forests and plowing up grasslands, people have made it easy for rain- and meltwater to run off instead of sinking into the ground. There is always water standing underground. The top of this water is called the water table. In large parts of America the water table is getting lower.

By dumping wastes into lakes and streams people have done more than make these bodies of water unfit for fish. They have spoiled them as sources of water to drink and as playgrounds. We are even spoiling the air with the wastes we send into it.

Americans have mined their minerals wastefully, without stopping to think that it took millions of years for the minerals to collect in the earth. Once the storehouse

Salmon are protected by fishing laws.

is empty, it will take millions of years to fill it again.

What can be done? In many cases the harm already done cannot be undone. But much can be done to prevent waste in the future. And some of the damage done can be repaired. Worn-out farmland can be built up with fertilizers into good land again. Forests can be replanted. Streams can again be made fit for fish.

The United States government has done a great deal to stop waste. Many laws have been passed. Forest preserves and national parks have been set up. Rangers guard against forest fires. Farmers are taught how to plow their land so that the soil is not as easily washed away. Game laws protect wildlife. The Wilderness Act of 1964 brought more than 60 million acres of wilderness under government protection. Fish hatcheries raise young fish to be put into lakes and streams. Great dams have been built to store up water. The story of what the government is doing is a long one.

Of course, the United States is not the only country that is interested in conservation. No country can afford to waste the riches nature gave it. Recently countries from all over the world have banded together to work on conservation, especially the saving of wildlife. (See BISON, AMERICAN; CROP ROTATION; EROSION; NATIONAL PARKS; PASSENGER PIGEON; SOIL; WATER SUPPLY.)

CONSTELLATIONS The stars we see as we look up at the sky at night are not scattered evenly across the whole sky. Instead, they are in groups. A group of stars is called a constellation. "Constellation" means "stars together."

The people of long ago saw the constellations as pictures in the sky. The names they gave them tell us what pictures they saw. Most of the constellation names we use came down from the Greeks and Romans. Among them are Taurus (the Bull), Canis Major (the Big Dog), Pegasus (the Winged Horse), and Draco (the Dragon).

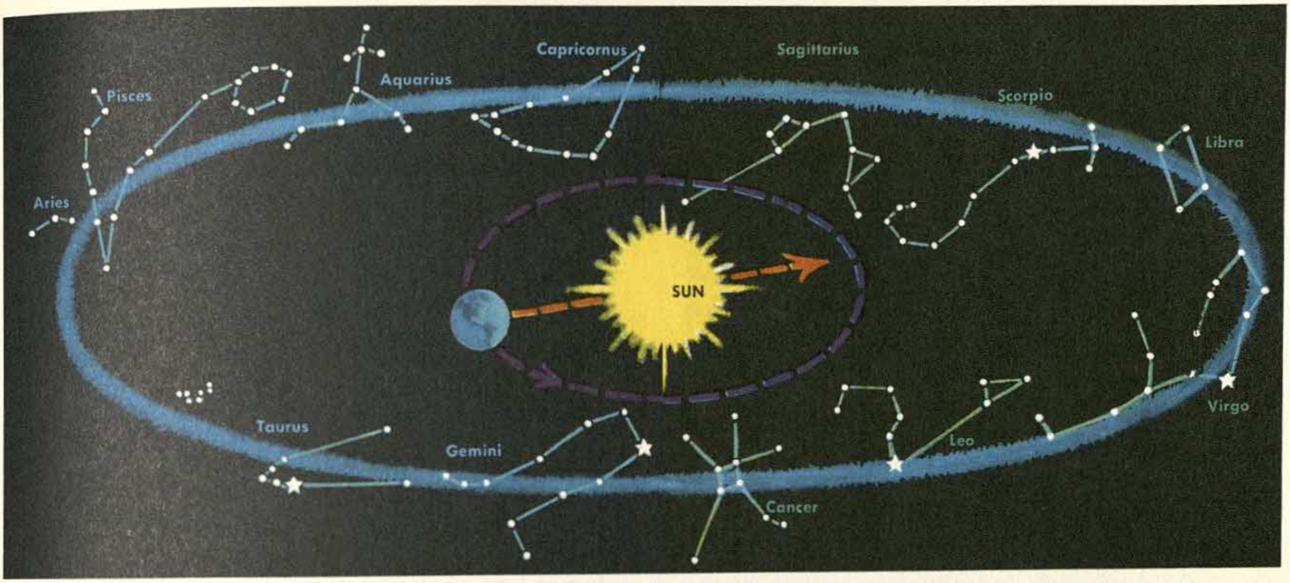
There are constellations in every direction from the earth. But only from the equator can they all be seen. Some of the constellations that people in the northern hemisphere see can never be seen by people in the southern hemisphere, and the other way round. In Argentina, for instance, people never see the Little Dipper. In most of the United States the Southern Cross cannot be seen.

What constellations we see when we look up at the sky depends partly, then, on where we are on the earth.

The two constellations at the bottom of the next page are both visible from the United States, but never at the same time. The constellations we can see in the night sky change with the seasons. They change because of the journey of the earth around the sun. No one sees Orion on the Fourth of July or Scorpio on Christmas Eve.

What constellations we see when we look up at the sky depends partly, then, on what time of year it is.

The night sky also changes from hour to hour. The turning of the earth makes some constellations seem to travel in a circle in the sky. Halfway between the equator and the North Pole, for instance, the Big Dipper is always visible, no matter what time of night it is. It seems to circle around the North Star. The farther north one goes, the more constellations there are that never disappear below the horizon. But in most

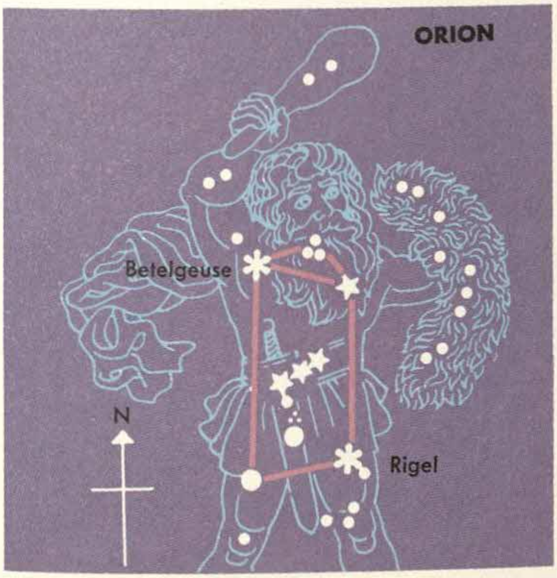


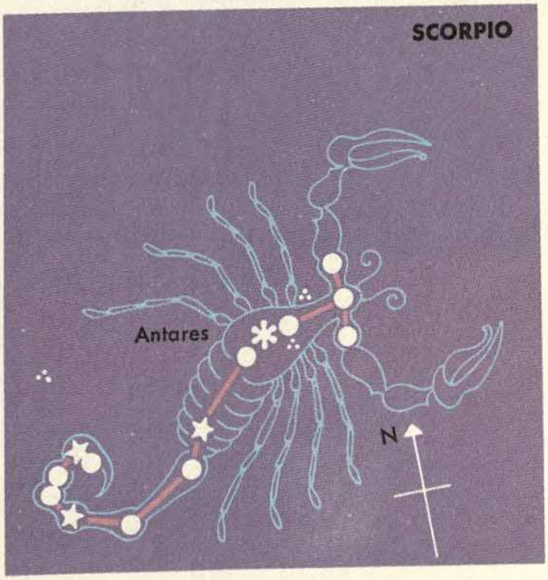
The Constellations of the Zodiac

places the turning of the earth makes some constellations rise and set. Constellations visible in the western sky just after sunset will have set by midnight, and other constellations will have risen in the east.

What constellations we see as we look up at the sky depends partly, then, on what time of night it is.

There are a great many star myths. They come from all parts of the world. The people of earlier times were not satisfied with simply naming the pictures the stars made. They made up stories to explain how each constellation came to be in the sky. Orion, the Hunter, is the brightest constellation in the sky. One Greek myth tells that the goddess Artemis killed him by mistake with one of her arrows and then put him in the sky. According to another myth it was Scorpio, the Scorpion, that killed Orion. Scorpio, as the diagram shows, is one of the constellations of the zodiac, the ring of constellations along which the sun, as viewed from the earth, seems to journey each year. (See ASTROLOGY; BIG DIPPER; STARS; ZODIAC.)





CONTINENT, LOST More than 2,000 years ago Plato, a famous Greek philosopher, wrote about a continent that he called Atlantis. This continent, he said, had been west of the Pillars of Hercules, the gateway between the Atlantic Ocean and the Mediterranean Sea. Its people had been highly civilized. But a great earthquake had made this continent sink below the sea 9,000 years before Plato's time.

Plato may not have expected anyone to believe in Atlantis. But many people thought the story was true. Some people still believe in this lost continent.

Changes are, of course, always taking place in the earth's surface. Small islands have appeared and disappeared. Volcanic eruptions build up new mountains and tear the tops off old ones. Coastlines change. Earthquakes are fairly common. But scientists have found nothing to show that any large amount of land has sunk below the sea in the past 100,000 years.

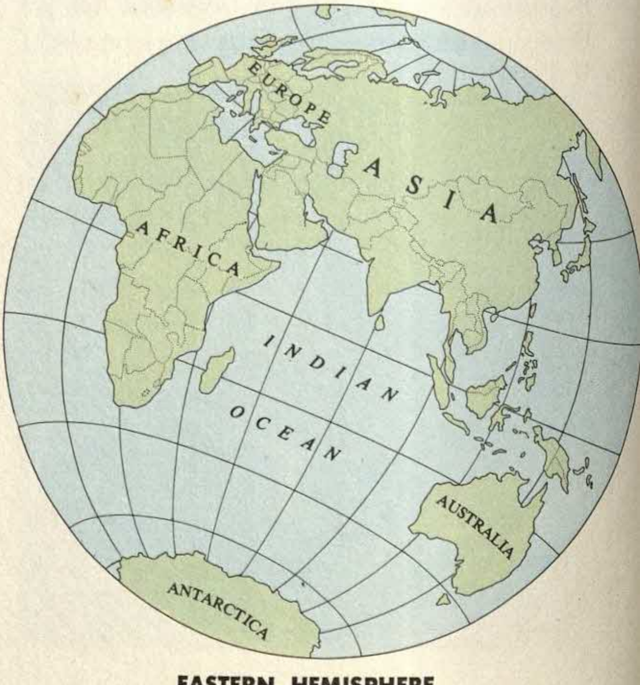
There are stories that there was once a large island in the Atlantic where the small Azores are now. But this island, if there ever was one, disappeared 10 or 15 million years ago, long before there were any people on the earth.

A short time ago newspapers carried a story saying that a clue to Atlantis had been found. Archaeologists exploring the Greek island of Thera in the Aegean Sea unearthed the ruins of an ancient city. It had been buried by volcanic ash for 3,500 years. Many signs told that its people had been highly civilized. The archaeologists say that the city must have been much like the one on Atlantis Plato had described.

Thera is by no means big enough to be called a continent. It is a crescent-shaped island only 11 miles across. It is east, not west, of the Pillars of Hercules. And it was buried by a volcano, not sunk below the sea. But mistakes could have been made when ancient records of it were translated from Egyptian into Greek. Perhaps more study of the ruins will tell whether Thera is really Plato's Atlantis.

If Atlantis never did exist, it would not be the only imaginary land people have believed in. Less than 300 years ago, for instance, a sea captain brought to Scotland some people he said he had rescued from a wicked magician on the island of Hi-Brazil west of Ireland. There turned out to be no such island, but for more than 100 years afterward Hi-Brazil was put on maps.

WESTERN HEMISPHERE



EASTERN HEMISPHERE

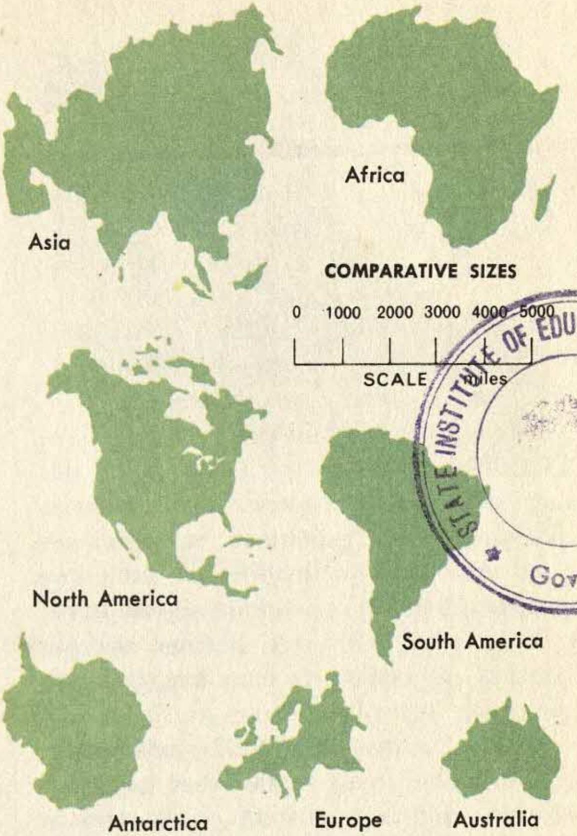
CONTINENTS A little less than one-third of the earth's surface is land. All the rest is covered with water. The land is not all joined together. There are thousands of islands. Besides, there are seven big pieces of land that are called continents.

The seven continents are North America, South America, Europe, Asia, Africa, Australia, and Antarctica. Australia and Antarctica are the only continents that are entirely separated by water from every other continent. North America and South America are joined to each other by a narrow neck of land. So are Africa and Asia. And Asia and Europe are joined together for such a long distance that they are sometimes called just one continent. The name given it is Eurasia.

If North and South America were pushed over against Europe and Africa, they would fit well. South America's bulge would fit below the bulge on Africa's west coast. And North America's east coast would curve around Africa's bulge and along the west coast of Europe. About 60 years ago a German scientist, Alfred Wegener, suggested that the continents had once been joined and had then broken apart and drifted to their present positions. Until recently most scientists scoffed at this idea. But many scientists have now come to believe in continental drift. Some think that all the continents were once one, others that there were two great land masses.

More than the shape of the continents has made scientists believe in continental drift. Rock formations and fossils that are the same on both sides of present oceans are other signs. Masses of rock in Australia, for instance, match rock along India's coast. And fossils of the Coal Age are much the same everywhere.

How could continents drift apart? They are certainly not floating in water. One idea is that, a hundred miles or so below the surface of the earth, there is a layer of rock that is molten or at least near the melting point. The rock layers above can slip on it, scientists think, just as the skin of an onion can slip about.



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As you see from the chart, Asia is by far the largest of the seven continents and has by far the biggest population. Over half of all the world's people live here.

If all the people in the world were scattered evenly over the seven continents there would be roughly 65 people for every square mile. But of course they are not scattered evenly. There are vast hot deserts and ice-covered regions and many mountaintops where few if any people live. Europe, with little waste space, averages the most people per square mile—over 300.

CONTINENT	SIZE IN SQUARE MILES	POPULATION
Africa	11.500,000	320,000,000
Antarctica	5.500.000	Very few
Asia	17,000,000	2,000,000,000
Australia	3,000,000	11,500,000
Europe	3,850,000	835,000,000
North America	8,500,000	300,000,000
South America	6,900,000	175,000,000

COOKING Imagine our meals if we did not cook any food. Celery and strawberries and many other fruits and vegetables are good uncooked. So is milk. But not many people would enjoy raw liver or raw sweet corn or plain raw eggs. Besides, without cooking we could not have soups, bread, pie, cake, or cookies.

Cooking makes many foods taste better. It also makes many foods easier to digest. Cooking makes some foods much safer to eat, too, for the heat of cooking kills germs that may get into food.

No one knows when or how cooking began. Perhaps a very long time ago some fresh meat fell in a fire by accident. Soon it began to cook. It smelled very good. When the fire died down, the meat was taken out and tasted. It was so good that from then on many foods were cooked.

When Europeans first came to the New World the Indians were cooking in simple ways. This was one way: They built an open fire. When it had died down, they put pieces of meat wrapped first in leaves and then in mud in the hot coals. When the meat was done, they broke off the covering of baked mud and leaves.

We still do some cooking for fun with open fires, but most of our cooking today is done with stoves of some sort. With our stoves we can cook food in many different ways. The chief ways are baking and roasting, frying, broiling, braising, boiling, and steaming. The newest way of cooking is electronic.

Baking means cooking in an oven. The meat we today call roasted is really baked. Originally, roast meat was cooked by hanging it over hot coals or in front of a flame.

When food is fried, it is cooked in fat on top of the stove. If it is cooked in deep fat, we sometimes say that it is French fried.

In broiling, slices of meat or other moist foods are cooked on a rack close to a flame or an electric burner. Dry foods like bread are toasted in the same way.

Braising means first browning the food in fat and then cooking it with the pan covered. Usually some liquid is added before the lid is put on. Pot-roasting and fricasseeing are other names for braising.

In colonial times most cooking was done over an open fire. The cook of today has a gas or electric stove. Modern cooking is easier, cleaner, and quicker.

We boil food in water on the top of the stove. It is the heat of the boiling water and not the bubbling that cooks the food. In pressure cookers a tight-fitting lid holds in much of the steam from the boiling water. Food cooks fast in a pressure cooker because the water gets much hotter than boiling water usually is.

Some foods are cooked over boiling water instead of in it. The steam that comes from the water does the cooking.

In an electronic oven radio waves strike the food to be cooked and heat it. The oven itself does not get hot. Cooking in this way is amazingly fast. A potato bakes in just four minutes!

One secret of good cooking is to use the right amounts of salt and other seasoning. Here are three other secrets: Use the right amount of heat. In boiling, use as little water as possible. Do not overcook food.

COPERNICUS (1473–1543) The year before Columbus reached America, Mikolaj Kopernik entered the University of Cracow in Poland. He was to become as famous as Columbus, but not many people know him by his Polish name. He is known by his name in Latin—Copernicus.

Copernicus did not make himself famous by finding a continent. Instead, he wrote a book about astronomy. It had so many new ideas in it that he is called the father of modern astronomy.

After Copernicus finished his work at the University of Cracow, he went to Italy to study. At Cracow he had become interested in astronomy. He wanted to learn more about it. In Italy he watched the stars and kept records of what he saw.

While he was in Italy, Copernicus was elected a canon of the cathedral of Frauenburg in Poland. After a few years he returned to Poland, but soon was given permission to study in Italy again. He became learned in mathematics, medicine, theology, and astronomy. In 1503 he went back to Poland and spent the rest of his life there.

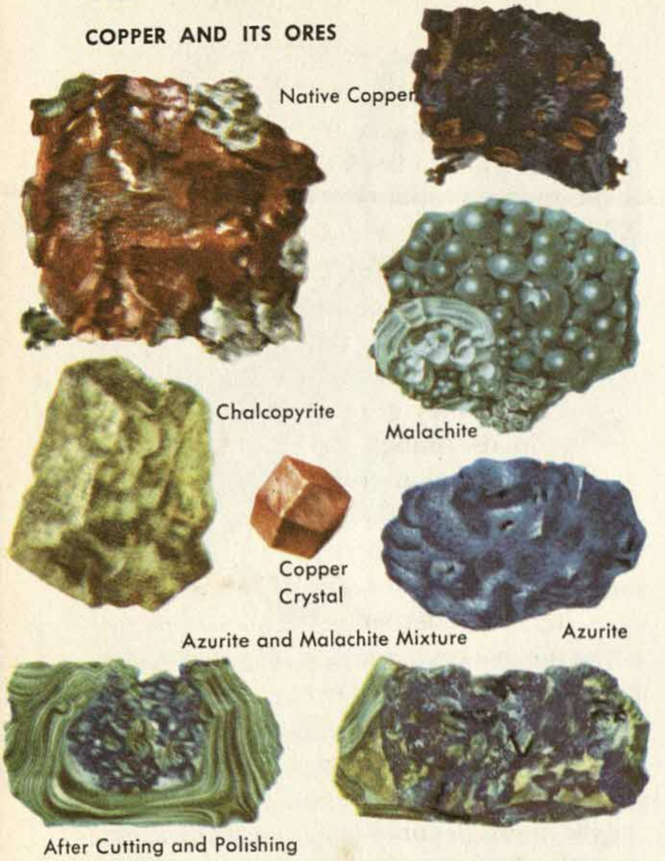
The duties of Copernicus as canon allowed him to continue to study astronomy. But Copernicus did not do much stargazing. He was more interested in working out an explanation of what he had already seen.

In his time people thought that the earth was the center of the universe and that the sun and stars turned around it. Very early in his study of astronomy Copernicus decided that this idea was wrong. He had these ideas: The earth travels around the sun, spinning as it goes. The earth is just one of the sun's family of planets.

Other learned people heard of these ideas and wanted Copernicus to publish a book about them. Copernicus did not wish to do so. Many churchmen, he knew, would not be pleased with a book saying that the earth was not the center of the universe. They would call the idea a threat to religion. He did put his ideas in writing but kept the manuscript. Finally he allowed a friend to take it to a publisher.

The book came off the press in 1543. A copy of it reached Copernicus on the day he died. He did not live to see the great storm his ideas stirred up. They seem so simple to us now that it is hard to understand why the people of his day fought so hard against them. (See ASTRONOMY; EARTH; GALILEO; SOLAR SYSTEM.)

COPPER AND ITS ORES



Open-pit Copper Mine in Southwestern United States

COPPER Of all the many metals, copper was one of the very first to be used by man. Only gold has been used as long. No wonder copper was discovered early. All that ancient man had to do was to pick it up from the ground. For copper, like gold, is often found in the earth as a free metal.

Not many metals are found free. Most of them are found only in ores. There they are mixed or joined with other materials. Getting metals out of their ores and refining them may be very hard. Copper is not by any means always found free. There are many copper ores. A few are pictured.

At first ancient man probably prized copper just for its beauty. But soon he discovered that he could make much better tools of it than of stone.

While digging around in the earth for copper, ancient man must have found tinstone. In time he learned how to get the metal tin from it. By melting tin and copper together, he made bronze. Bronze is harder than copper and therefore more useful for tools and many other things. Still later, man found that by melting zinc and copper together he could make brass. Mixtures such as bronze and brass are called alloys. Copper and bronze were man's most common metals until he learned how to get iron from its ores.

Most of the metal objects we use today are made of iron or steel. But copper is still widely used. Since, next to silver, it is the best conductor of electricity, copper is made into wire for carrying electric current. Almost every electrical appliance we use has copper in it. Copper carries heat well, too. Many cooking pans are part copper. Copper is used in the building of ships because it does not corrode easily.

Copper is used widely in artwork. It has a beautiful color and can be given a high polish. The statues in our parks and public places are generally made of bronze. Many medals and coins are made of copper or its alloys. Buildings are sometimes trimmed with copper. One of every ten tons of copper used in the United States goes into alloys for automobiles.

Today almost all the copper we use comes from copper ores. Copper is mined in many sections of the world. Leading copper-mining countries are the United States, the U.S.S.R., Chile, and Zambia. The picture shows one of the big copper mines in the United States. Carloads of ore are scooped up. They go to big smelters, where the copper is taken from the ore. (See ALLOYS; BRONZE.)

COPYRIGHT Suppose a boy wants to print a small newspaper to sell to his friends. He reads the material about dinosaurs in this encyclopedia and decides to copy it in his paper. Is there any reason why he shouldn't? One word tells the answer. It is the word "copyright."

This word is on one of the first pages of every book printed in the United States. It means, "No one has a right to copy and sell this book or any part of it unless the author or publisher says that he may."

A copyright protects the author and the publisher of a book. Long ago, anyone could copy another author's work. In Shakespeare's time a printer might listen to one of Shakespeare's plays, write it down, and then print it and sell it.

To get a copyright in the United States the writer or publisher must send copies of the work to the Copyright Office in Washington, D.C. He must also pay a small fee. The copyright he gets is good for the writer's lifetime plus 50 years.

Magazines, paintings, drawings, maps, plays, sermons, speeches, pieces of music, photographs, and motion pictures, as well as books, can be copyrighted. Titles and ideas, however, cannot be.

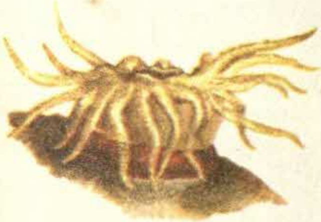
CORAL For nearly half a billion years tiny animals called corals have lived in the earth's warm seas. We know about the corals of long ago because they left behind them millions upon millions of the rock "houses" they built for themselves.

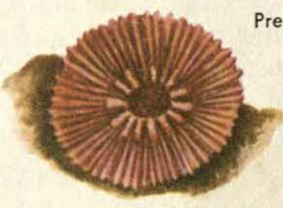
Corals are simple animals, with no bones, no heads, and no legs. They wave food into their mouths with a circle of tiny feelers. Corals look much like little flowers. And as a rule they grow much as plants do. New animals branch off from old ones. Soon a whole colony is built up.

Most of the corals pictured below are stony corals. Each little animal takes in lime from the water and walls itself up with it. The older animals die, but their limestone houses remain. The sea fan and sea whip are horny corals instead. Their houses are made of a hornlike material.

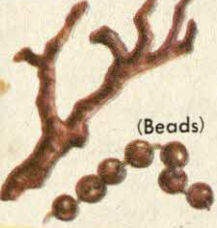
There have been so many billions and billions of corals that in many places in the Pacific reefs of coral limestone rise in circles above the surface of the sea. These circles are called atolls. Many islands of the Pacific are bordered by coral reefs.

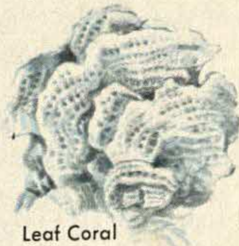
Coral animals are all much alike. But, as you see, the rock houses they build differ greatly in shape.

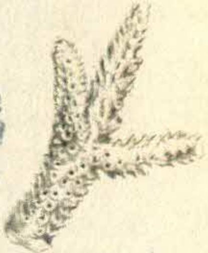

Stony Coral (Alive)

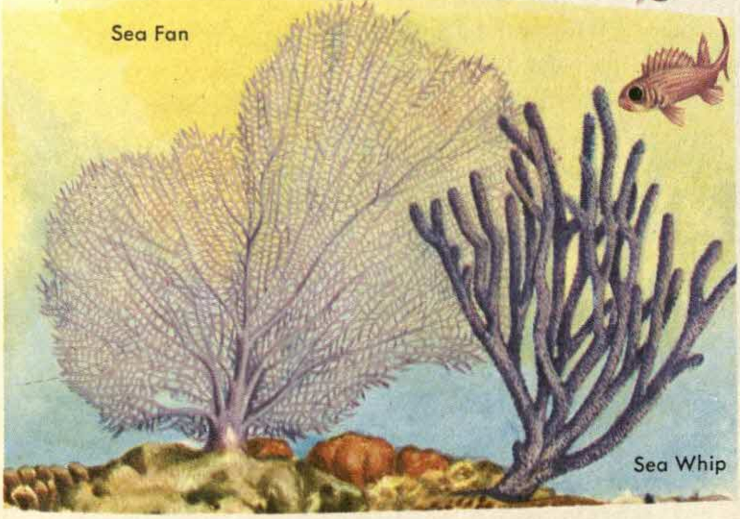

Stony Coral (Skeleton)

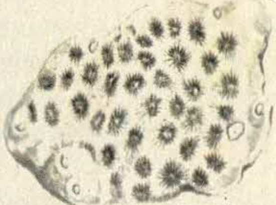
Precious Coral

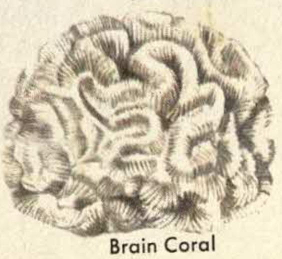



Leaf Coral


Staghorn Coral




Star Coral


Brain Coral

Workmen Cutting Cork

CORK Many glass bottles have cork stoppers to keep the contents from spilling. There are life preservers made with cork. Cork is used for hot-dish plates and in bottle caps. Coasters to put under glasses of ice water are often made of it. So are the handles, or grips, of fishing rods. Ground-up cork is used in floor tiles, and powdered cork in linoleum. The centers of baseballs are cork. Cork is also placed between the double walls of refrigerators and cold-storage rooms. It is used as a cushion under heavy machinery and as a sealer in gaskets.

Cork is certainly very useful. Here are four of the things about it that make it so: It is so light that it floats on water. It is waterproof. It is elastic. Heat cannot travel through it easily.

Cork comes from the bark of the cork oak. Most trees have cork in their bark. But no other tree has so much as the cork oak.

A cork oak has to be 20 years old before its cork is worth cutting. If the cork is then stripped off carefully, a new layer will grow. Every eight years or so the cork can be cut again. One big oak tree may furnish as much as 500 pounds of cork at a time. But most trees furnish much less.

Ordinarily the cork is boiled or steamed and then flattened. The rough outer layer is scraped off.

More than half of all the cork in the world comes from Portugal. Ships sailing from Lisbon often carry cargoes of baled cork. Spain and Algeria are other important suppliers. Some cork is now raised in California.

Buyers cut up the cork into the sizes and shapes they want. Some cork is cut so thin that 500 sheets would make a pile only an inch thick. (See BARK; LINOLEUM AND OILCLOTH; PORTUGAL; TREES.)

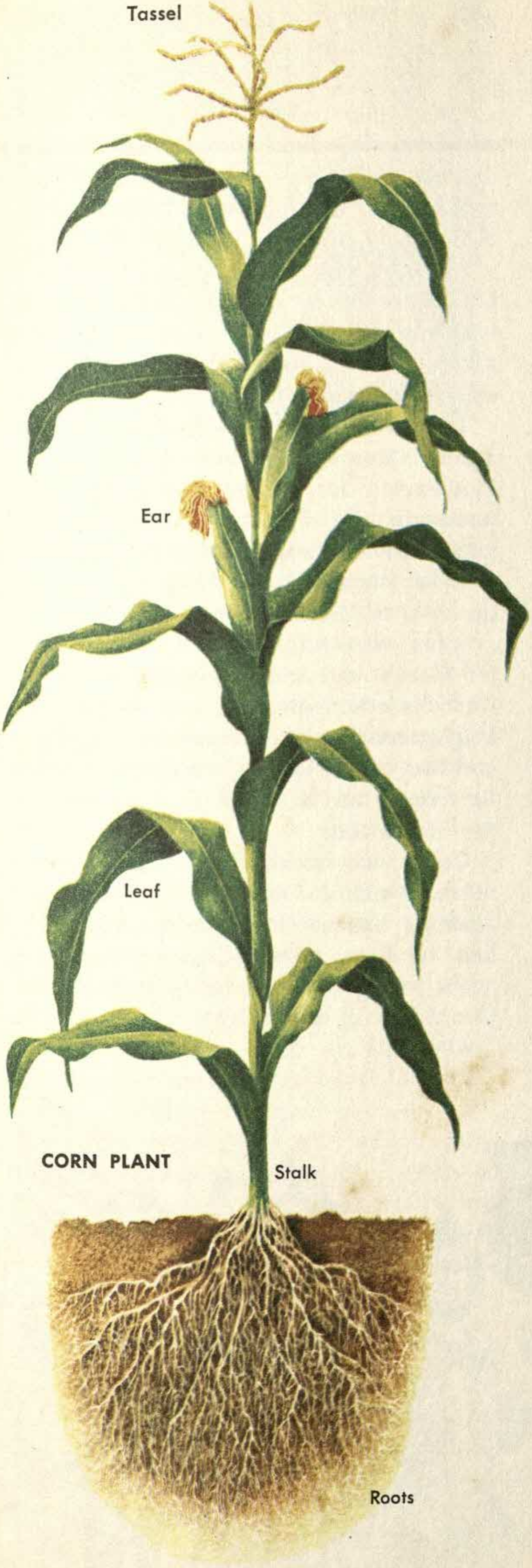
CORN All except one of the grains raised in the United States came from the Old World. The one truly American grain is corn. Maize is another name for it. One region in the United States is called the Corn Belt because so much corn is raised there. Corn is an important crop in many other countries, too.

Corn is a grass just as wheat, rye, rice, oats, and barley are. But it grows to be much bigger than most of its relatives.

For a long time corn was a puzzle to scientists. There is no wild corn anywhere. Neither is there any wild plant much like corn. Scientists now believe that corn came from the crossing, brought about in some way thousands of years ago, of two plants native to Mexico. One was pod corn, a plant that bore tiny ears less than an inch long with 50 or so little kernels on each ear. The other was a much sturdier plant called teosinte. At any rate, the Indians of Mexico were raising corn 4,000 years before the time of Columbus. Its use spread over both Americas. Friendly Indians brought corn to the Pilgrims and showed them how to plant it in little hills and fertilize it.

The kernels on an ear of corn are seeds wrapped in a thin covering. In each grain a baby plant lies in a bed of food, which is mostly starch. A corn plant has two kinds of flowers. The tassel at the top of the stalk is made up of flowers that furnish pollen. The flowers where the seeds form are lower on the stalk. The silks are parts of these flowers. Pollen must reach the silks before seeds can form.

Much corn is eaten as a vegetable. A great deal more is fed to livestock. Besides,



CORN PLANT

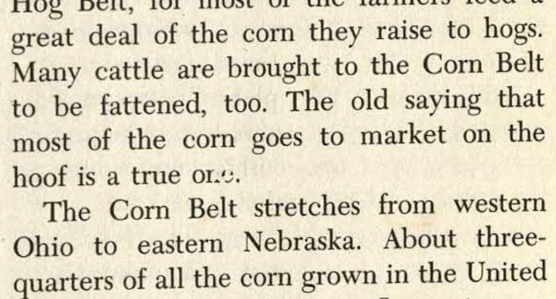
corn is used in manufacturing many things. Cornmeal, hominy, cornstarch, corn syrup, and cooking oil are some of the foodstuffs made from corn. Charcoal, alcohol, wallboard, and corncob pipes are other products manufactured from this big grass.

A great deal of the corn raised today is hybrid corn. Hybrid corn is a cross between different varieties. It usually produces much bigger crops than ordinary corn. (See CEREALS; FOODS; GRASSES; HYBRIDS; PILGRIMS; PLANT BREEDING.)

CORN BELT The Corn Belt is the part of the United States that leads in the growing of corn. The soil is good for corn growing. So is the climate. There are many summer showers, and the summer nights as well as the days are warm.

The Corn Belt might also be called the Hog Belt, for most of the farmers feed a great deal of the corn they raise to hogs. Many cattle are brought to the Corn Belt to be fattened, too. The old saying that most of the corn goes to market on the hoof is a true one.

The Corn Belt stretches from western Ohio to eastern Nebraska. About three-quarters of all the corn grown in the United States comes from this area. In most years Iowa is the leader, and this state is often called the "land where the tall corn grows." Corn is not the only crop grown on Corn Belt farms, but always much of the land is planted in corn. A traveler in the area sees so many cornfields that he does not need to be told he is in the Corn Belt.



CORTÉS (1485–1547) Hernando Cortés was a boy in Spain at a thrilling time. Columbus made his first trip to the New World when Cortés was seven. Soon many Spaniards were on their way to the Americas to find their fortunes. Cortés made up his mind to go to the Americas, too. When he was 19, he sailed for the West Indies.

For several years Cortés stayed in the West Indies as a planter. Then for a time he was the mayor of a city in Cuba. But his real adventure began in 1518. In that year he set out with 11 ships and several hundred men to explore Mexico.

Soon after he reached the coast, Cortés established a settlement there. He made friends with the Indians nearby.

At that time the Aztec Indians had a rich kingdom in central Mexico. The Aztec ruler was Montezuma II. He lived in a city built in the middle of a lake. It stood where Mexico City is now. Cortés was eager to conquer the Aztec kingdom.

Before setting out for the Aztec capital, Cortés had his ships destroyed. He wanted to be sure that none of his men could go back to the West Indies.

It was a long, hard trip from the coast to the capital of the Aztec kingdom. There was much fighting along the way.

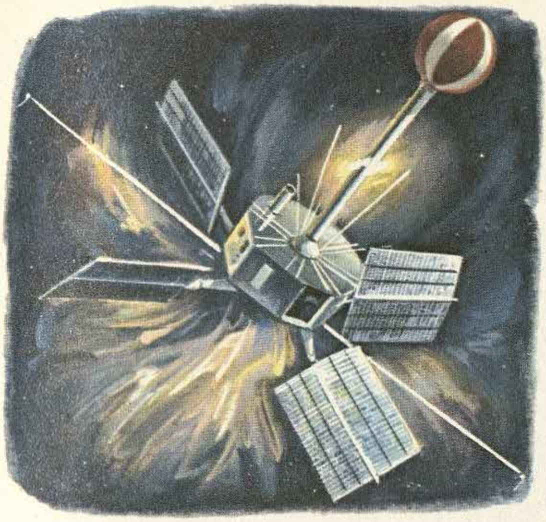
When Montezuma heard that the Spaniards were coming, he sent some of his nobles to tell them to come no farther. With the nobles there were slaves carrying wonderful gifts. Among these gifts there were plates of gold and silver as big as cartwheels, a helmet filled with gold dust, and armor decorated with solid gold. Montezuma hoped the Spaniards would take the rich gifts and go home. But Cortés wanted more than ever to take over the kingdom.

As Cortés neared the capital, Montezuma himself went to welcome him. The meeting was friendly. But, soon after he reached the city, Cortés went to the palace with his officers and made Montezuma a prisoner.

The Aztecs rose up against Cortés and against Montezuma, too. They blamed Montezuma for letting himself be captured. In the fighting Montezuma was killed. Cortés escaped from the city. But soon he fought his way back and became the ruler of Mexico.

A few years later enemies made trouble for Cortés and seized his goods. Cortés went back to Spain to plead his case. The king agreed that he could do more exploring and that he could keep part of any riches he found. But he chose someone else to govern Mexico.

Cortés went back to Mexico, but he found no more riches. Discouraged, he returned again to Spain. This time the king gave him no help. Cortés died without ever again seeing the land he had conquered. (See AZTECS; MEXICO.)



Explorer XVIII, Helpful in the Study of Cosmic Rays

COSMIC RAYS Early in the century it was noticed that odd things were happening to some science experiments. Rays of a strange kind were reaching them. They were like X rays, but they were not X rays.

Scientists wondered if the rays could be coming from far outside the earth. To find out, and to learn more about these strange rays, they went here, there, and everywhere studying them. They went into caves and into the great cracks in glaciers. They went deep down under the sea and up to the tops of high mountains. In balloons they went higher in the air than anyone had ever gone before. They even went into such out-of-the-way places as the mouth of a big cannon and the underside of great piles of salt. Finally they could say for certain that the rays come from out beyond the earth. They named them cosmic rays.

Although cosmic rays still hold mysteries, scientists now know a great deal about them. The rockets and artificial satellites of the space age have been especially helpful in finding answers to scientists' questions.

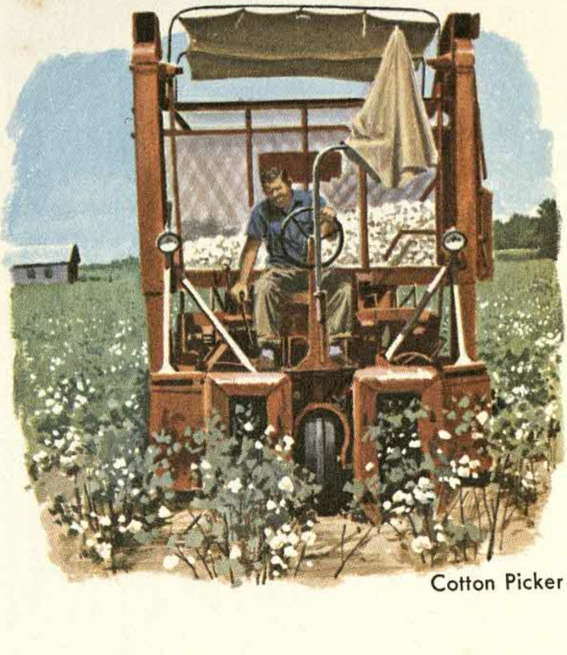
Knowing about cosmic rays has proved useful in important ways. It brought about, for instance, the use of carbon 14 in dating things from the past. And it has led to a far better understanding of the great universe around us.

COTTON A bouquet of cotton blossoms would be pretty. But no one picks cotton blossoms for bouquets. The blossoms are left on the cotton plants to form seeds. The seeds themselves are useful, but even more useful is the fluffy white cotton fastened to the seeds. About three-fourths of all the people in the world today wear cotton clothing.

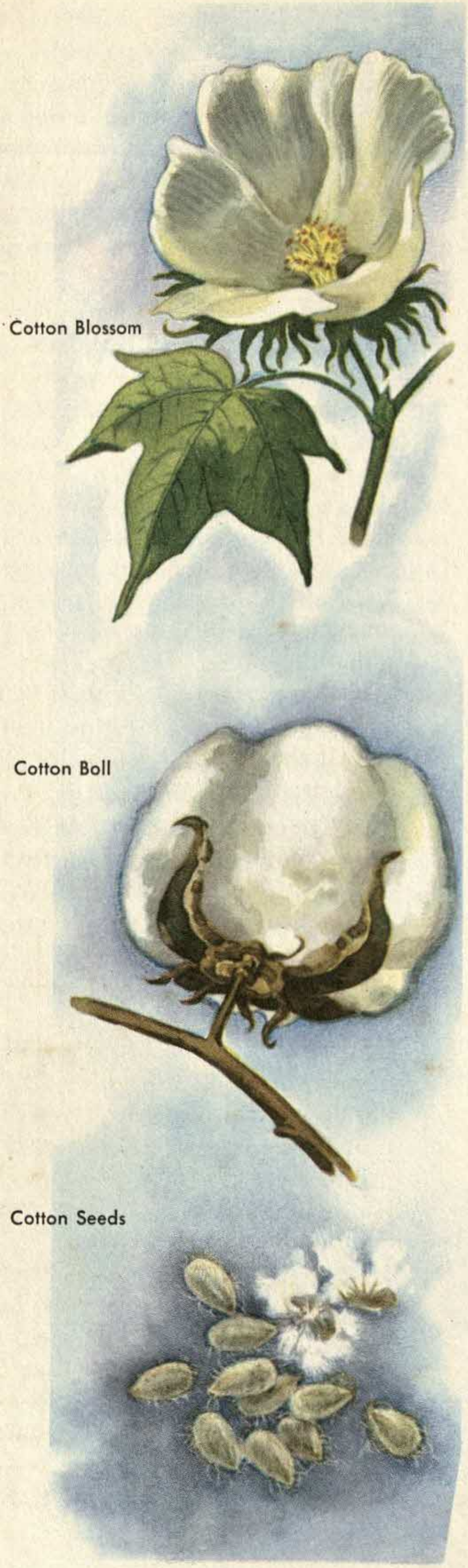
Cotton must have a long growing season —200 days without frost. For that reason it grows only in warm climates.

People in India were raising cotton as far back as 5,000 years ago. The Indians of Peru and Mexico had fields of cotton long before the days of the Spanish explorers. Now the United States raises more cotton than any other country in the world. All the southern states grow cotton. Arizona, California, and New Mexico are cotton states, too. The cotton crop of the United States brings in more than two billion dollars a year.

Cotton seeds are planted in early spring. After the plants are fairly large, "cotton choppers" thin out the rows. Most cotton plants grow to be about three feet tall. Their flowers are white at first but soon turn red. Each flower forms a seedball, or boll. The boll becomes about as big as an egg. When it is ripe, it opens. Then



Cotton Picker



it looks like a snowball. In a cotton field ripe bolls, green bolls, and white and red flowers can all be seen at the same time.

Much cotton is still picked by hand. But cotton-picking machines are used more and more. After the cotton has been picked, the seeds must be removed. Until Eli Whitney invented the cotton gin in 1793 the seeds were taken out by hand. The "iron fingers" of the gin do the work much faster.

The cotton is baled for sale. Cottonseed oil is squeezed from the seeds. It is used in margarine, shortening, salad dressing, cooking and salad oils, and soap. The crushed seeds become cottonseed meal, a good food for cattle.

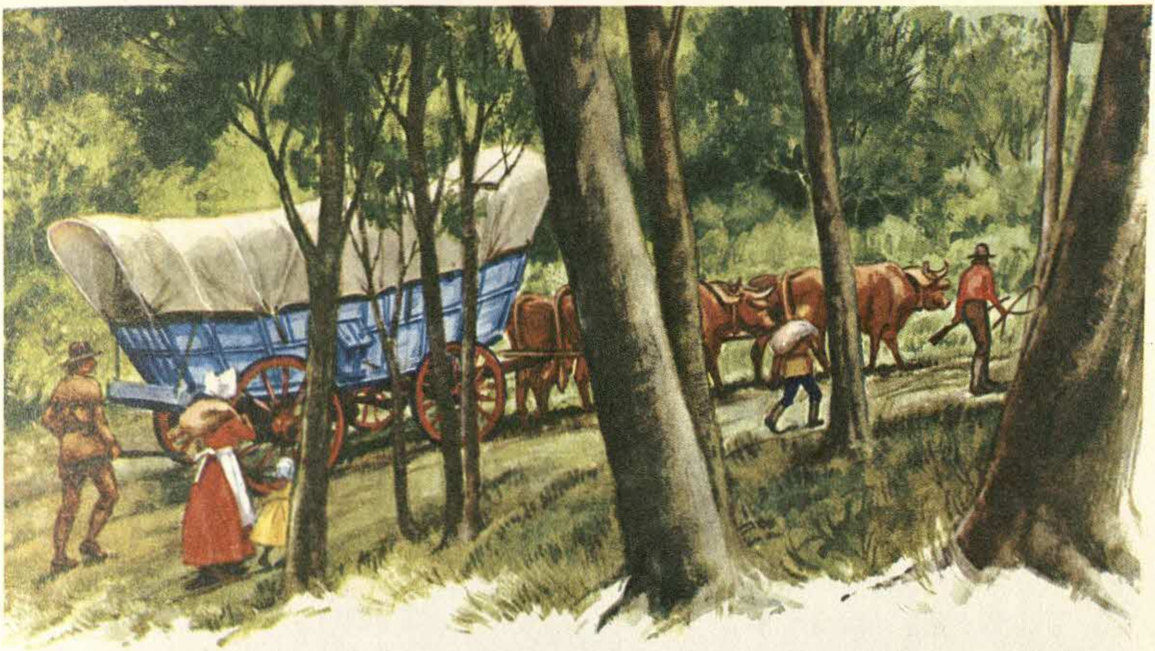
Cotton plants have many enemies. One of the most harmful is a beetle called the boll weevil. (See FIBERS; TEXTILES.)

COUNTERFEIT If we say that something is counterfeit, we mean that it is an imitation meant to deceive people. Bogus, sham, and fake are other words that can be used instead. When people hear the word counterfeit they are likely to think of money. For ever since men have used money it has been counterfeited.

In the days when silver and gold were the chief kinds of money, counterfeiters substituted cheaper metals for some of the silver and gold. When governments began issuing paper money the temptation to make counterfeit money became much greater. To make a counterfeit gold or silver coin one still had to have some of the expensive metal. Paper is far less valuable than silver or gold. Besides, it costs no more to make a big bill than a small one.

To make a counterfeit bill, a person needs two metal plates, one for each side. The plates must be copies of the two sides of a genuine bill. The counterfeiter must also have a printing press, suitable paper, and ink of the right colors.

Making an exact copy of the design on a bill is not easy. Only an excellent draftsman can do a good job. No one person is



likely to be a good enough draftsman and platemaker and printer to make counterfeit paper money all by himself. Usually, therefore, counterfeiters work in groups.

As a guard against counterfeiting, the United States government urges people to know their money. These are two common defects in counterfeit bills: The paper is not right—U.S. paper money is printed on special paper with tiny silk or nylon threads in it. The design is not well done; poor work usually shows up in the portrait.

Some 90 nations work together in an organization known as Interpol to prevent counterfeiting. Anyone convicted of counterfeiting must pay a heavy penalty.

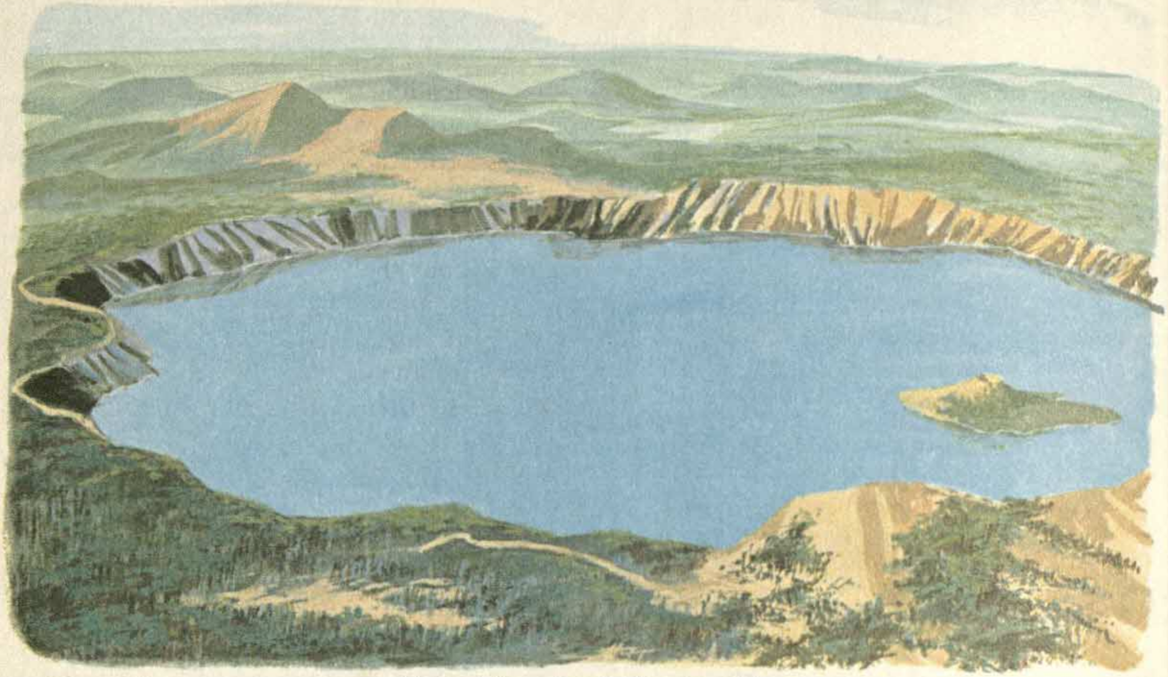
COVERED WAGON Many pioneers crossed our great prairies and plains to the West before there were any railroads. Most of them traveled by covered wagon. Sometimes as many as a hundred covered wagons made the journey together so that there would be greater safety from Indian attacks.

The wagons were sturdy and had broad-rimmed wheels to keep them from sinking down in the mud. They were higher at both ends than they were in the middle, and the back wheels were larger than the front ones. Each wagon had a great canvas cover that made it look top-heavy. The canvas cover was held up by arches made of iron or wood. It could be drawn shut at the ends. If the people wished, a peephole could be left.

The covered wagons had to be big. They had to carry food for several weeks or even months. Besides, they had to carry clothing and quilts, pots and pans, and other things, too. A family lived in its covered wagon very much as families live now in trailers.

Travel by covered wagon was slow, for the wagons were pulled, as a rule, by oxen. In trains of wagons traveling together there were usually some men on horseback. But they had to slow down at times to stay with the oxen and any cattle or other livestock following behind.

As the wagons moved slowly through the waving grass of the prairies, they looked a little like boats bobbing on the sea. They were often called prairie schooners. They had another name, too. It was Conestoga wagon. This name came from the name of the place in Pennsylvania where Conestoga wagons were first made. (See PIONEER LIFE IN AMERICA.)



Crater Lake, a Scenic Wonder of Oregon

CRATER LAKE Not many lakes are at the tops of mountains. Crater Lake is. It is high in the Cascade Mountains in the crater of a dead volcano.

Crater Lake is one of the most beautiful lakes in the world. It is a brilliant blue. High, steep walls made of lava surround it. In places the lava is twisted into odd and interesting shapes. Evergreen trees cover some of the walls.

The lake is about six miles across. At one place near the edge a strange rocky island rises above the water. Seen in moonlight it looks like a ship under full sail. But when the moonlight strikes it from a certain direction the "ship" suddenly disappears. No wonder it is called Phantom Ship. Another island in the lake is named Wizard Island. It is a tiny volcano with a crater at the top.

For a long time Crater Lake was a great puzzle. For one thing, it is about 2,000 feet deep—deeper than any other lake in the United States. For another thing, it is much larger than anyone would expect a lake in a crater to be. The largest active crater in the world, Kilauea in Hawaii, is only three miles across—much smaller than the big bowl that holds this lake.

Now scientists have solved the puzzle. The story they tell is the story of a volcano that swallowed its top. The volcano, Mount Mazama, had its beginnings about 12 million years ago. It erupted time after time, and each eruption built it higher. At last it was more than two miles high. Then came a long period of quiet. It was so long that rivers of ice formed high up on the sides of the tall mountain and moved slowly down its valleys.

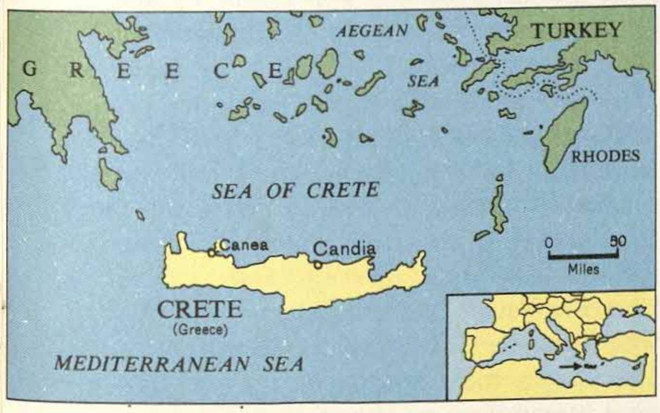
About 6,500 years ago, however, there was a violent, earth-shaking eruption. An enormous amount of lava was blown out of the top of the volcano. At the same time much of the hot, liquid rock deep down under the volcano drained away and a tremendous cavity thousands of feet deep was formed. The top of the mountain, with nothing below to prop it up, tumbled into the cavity. Of course, the cavity was partly filled up by the mountaintop it had swallowed. Even so, the huge new crater was very deep.

Water from rain and snow formed a lake in the crater. But the volcano was not yet completely quiet. There were other less violent eruptions. In one of them Wizard Island was built.

The lake stays about the same depth year after year. There is no known outlet. Perhaps an underground channel carries water away. As you see from the picture, the lake does not fill the crater. The rock walls rise from 500 to 2,000 feet above its surface. (See NATIONAL PARKS; OREGON; VOLCANO.)

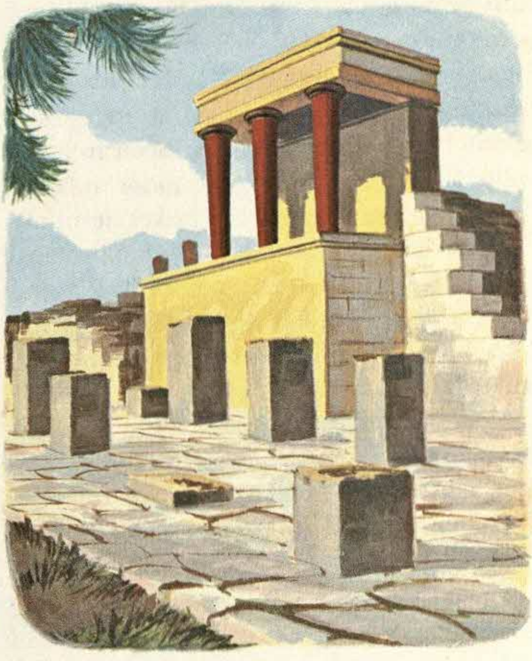
CRETE The island of Crete is in the Mediterranean Sea south of the Greek mainland. It is not a very big island compared with some others in the Mediterranean. Crete is 160 miles long but only 6 to 35 miles wide. It has a high ridge of mountains that go up to 8,000 feet. One of its mountains is Mount Psiloriti, called Mount Ida in ancient times. It played an important part in stories of Zeus, the king of the Greek gods.

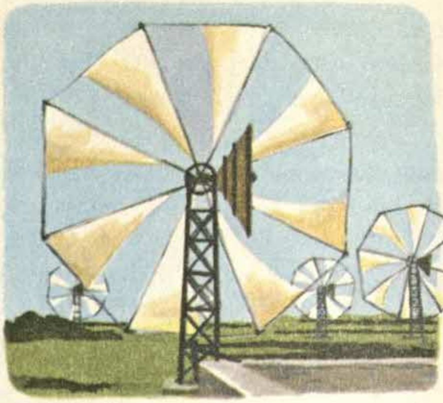
We hear a great deal about ancient Egypt and ancient Babylonia. We do not hear nearly as much about ancient Crete. But back in the days when Egypt and Babylonia were leading centers of civilization, the people of Crete were also highly civilized. While the neighboring Greeks were still living in crude villages, the people of Crete had built beautiful cities with huge palaces. Four thousand years ago Crete was a busy, wealthy island.



There are ruins on the island now of many of the ancient towns and cities. In one city there are ruins of a vast royal palace. It is called the palace of Knossos (NOSS us). The king's throne in this palace is the most ancient one in all Europe. The palace covered what would amount to about four city blocks. Over the centuries earthquakes and fires have destroyed it. When the palace was built, there were hundreds of rooms in it. One of the rooms was the queen's bathroom. In it the queen's bathtub was found. In a nearby room there was a baby's bathtub. Pipes of clay tile carried water all over the palace. The kings and queens of Europe did not have such luxury for many, many centuries.

One of the myths of ancient Greece told that the son of King Minos of Crete was





killed by the people of a town in Greece. As a punishment seven Greek maidens and seven Greek youths had to be sent to the king of Crete each year. They were fed to a monster called the Minotaur. This monster was kept in a labyrinth, a network of passages out of which it was very hard to find one's way. The Greek hero Theseus at last killed the Minotaur.

This story is just a myth. But there probably was a King Minos. The civilization of the ancient people of Crete is sometimes called the Minoan civilization. Its golden age was about 3,500 years ago.

Centuries before the Phoenicians became the great sea traders of the Mediterranean, sailors from Crete traveled far and wide over this big sea. In their boats they carried wares for trade. Pottery made in Crete has been found in lands all around the Mediterranean. Among the things the traders took in exchange for it were ivory and gold.

The Cretans used their boats not only in trade but also in war. Their rulers are often called the "sea kings of Crete." Some of the seamen were really pirates.

The Cretans had tools and pots and pans made of bronze. They had jars of pottery so thin that they were like our eggshell china. Their artists carved beautiful figures in ivory. They made well-designed ornaments of gold and silver, too.

Pictures on the walls in the ruins of Cretan cities tell us something about how the Cretans lived. They show boys and girls taking a bull by the horns and leaping over its back. They show wrestling and dancing. They show ladies in fine clothes, shepherds guarding their flocks, and farmers gathering grain and grapes.

The Cretans could write, just as the Egyptians and Babylonians could. They wrote on clay tablets. But they used forms of writing which were all their own. For many years no one could figure out what the tablets said. Now some of the writing has been read. The tablets that have been read, however, are just lists of people and commodities. When other Cretan writings have been translated, we may know much more about this ancient people.

The civilization of Crete began to decline more than 3,000 years ago. The island was conquered first by the Greeks and then by the Romans. In the ninth century Moslems forced out of Spain invaded Crete. The island then became a hiding place for pirates who were feared all over the Mediterranean. The Greeks took over Crete again in 960. Five hundred years later, after a siege of 20 years, the island fell to the Turks. Many of the Cretans became Moslems.

Today Crete is a part of Greece. It is a land of orchards and fields and pastures. The ancient ruins on the island were not uncovered until the early part of this century. Until then no one had guessed that Crete was an important stepping-stone between the first civilizations and the civilizations of Europe. (See GREECE; HISTORY; MEDITERRANEAN SEA.)

Ancient Lydian Coins

CROESUS (KREE sus) "As rich as Croesus" is a common saying. Croesus was a real person, and he was very rich indeed. He was the king of Lydia about 2,500 years ago. Lydia was a country in Asia Minor.

Croesus was rich because of gold and silver found in the sands of a river in his country. He made himself famous by refining this gold and silver and minting the first pure gold and silver coins in the world.

Lydia was a powerful country. When Croesus heard that the king of Persia was getting ready to make war, he was not greatly worried. But he sent messengers to a Greek oracle to ask how a war with Persia would turn out. The word brought back was that a great empire would be destroyed.

Croesus understood the message to mean that he would destroy the great empire of Persia. Instead, the empire that was destroyed was his own. Croesus sent his famous cavalry into battle, but his horses were terrified by the Persians' camels. Lydia was conquered and Croesus was taken captive. (See MONEY; PERSIA.)

CROP ROTATION All crops use up minerals from the soil. A farmer cannot expect his soil to stay rich if he raises crops on it year after year and never puts any minerals back into it.

But how can a farmer put back into the soil the minerals his crops take out? He can use fertilizers. He can also follow a good plan of crop rotation. Crop rotation means changing crops in regular order.

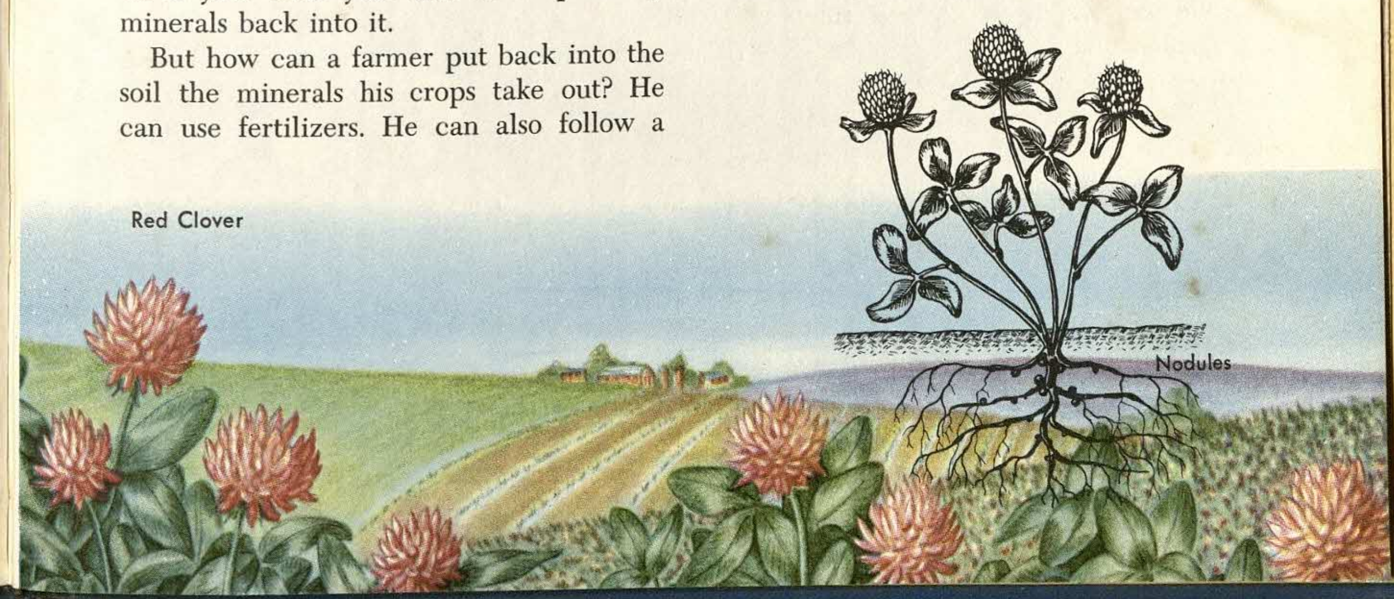
Some crops take more of one material from the soil. Some take more of another. Any crop rotation is probably better than raising such a heavy-feeding crop as corn year after year. But to be good a crop rotation must add something to the soil.

Grass is often used in a crop rotation. Plowing it under adds what we call humus to the soil. Humus helps change minerals that plants cannot use into minerals that they can use.

Clover is an even better crop for building up soil. Clover has tiny bumps on its roots. In the bumps there are bacteria of a special kind. They take nitrogen from the air and change it to a mineral that the clover plant needs. If, after the clover seed has been harvested, clover plants are plowed under, this mineral is added to the soil. So is humus.

Clover is one of the plants called legumes. Alfalfa, sweet clover, and lespedeza are other crops used to help keep soil fertile. All three are legumes.

Crop rotation does more than keep soil from wearing out. It also helps in fighting weeds and insects. If wheat were raised in a field several years in a row, weeds that can grow easily in wheat fields and insects that eat wheat would get a better and better foothold. But if crops are changed often, such weeds and insects do not have as good a chance to get established.



Red Clover

Pope Asking for Recapture of Holy Land

CRUSADES When Jesus was alive, the Holy Land was a part of the great Roman Empire. A few centuries later it was in the hands of Moslems. For a long time these Moslems were friendly to Christians who came to visit the land where Christ had lived. But in 1071 the Seljuk Turks captured Jerusalem. These Turks were Moslems, too, but they were not friendly to the Christians. Pilgrims on the way to the Holy City were sometimes beaten and robbed.

In 1095 the Pope called a meeting, to which thousands came. He urged Christians to rescue the Holy Land. At once people flocked to do as he wished. "God wills it," men would shout as they dropped their work to start on their journey. In this way the wars called the Crusades began.

The name "Crusades" comes from the Latin word *crux*. It means "cross." A cross was the badge of those on their way to fight for the Holy Land.

The first groups that gathered would not wait till careful plans were made. One of these groups, numbering about 12,000, was led by Peter the Hermit and a knight called Walter the Penniless. Some of the men in these groups were sincere Christians. Others were just vagabonds. Still others were trying to keep from being put in prison. These groups had no money. They had to beg their way. They were so eager to kill the Moslems that they began killing all who were not Christians. In return many of them were killed. Few lived to reach the Holy Land.

In contrast, the so-called First Crusade was led by noblemen who were trained warriors. Among them were Godfrey of Bouillon, Robert of Normandy, and Raymond of Toulouse. Their army reached the Holy Land and, after much fighting, captured Jerusalem. But they did little to show that they were Christians. They massacred both Moslems and Jews. Before many years the Moslems retook part of the land they had lost to the Crusaders.

In the next two centuries there were several other Crusades. Between the Second Crusade, which accomplished nothing, and the Third the Moslems under Saladin recaptured Jerusalem itself. The Third Crusade was led by two kings—Richard the Lion-Hearted of England and Philip of France—and an emperor—Frederick Barbarossa of Germany. Frederick Barbarossa was drowned. Philip returned to France. Richard conquered part of the Holy Land but failed to win Jerusalem.

Another attempt to rescue Jerusalem is known as the Children's Crusade. Thousands of children set out to do what warriors had not been able to. None of them reached the Holy Land. Many died of disease or hunger. Some were sold as slaves. Some turned back before it was too late.

There are many exciting stories of the Crusades. Pictures of Crusaders with their chargers and armor and banners are thrilling. But the whole story of the Crusades is not, it is clear, a very pleasant one. In the end the Holy Land was in the hands of the Moslems just as it had been at the start.

But, although the Holy Land was much the same after the Crusades as before, Europe was not. The Crusaders brought back from the East spices and satins and riches of other kinds. More important, they brought back new ideas. Their gloomy castles no longer seemed wonderful. They wanted a better way of living, and they set about getting it. The Crusades were failures as wars of conquest. But they pushed civilization in Europe ahead. They helped lift Europe up from the Dark Ages. (See KNIGHTHOOD; MIDDLE AGES.)

CRUSTACEANS Far more than half of all the kinds of animals in the world belong in the group of "jointed-legged" animals, or arthropods. This great group has in it the insects, spiders, centipedes, thousand-legs, and crustaceans.

There are not nearly as many crustaceans as there are insects, but there are thousands of kinds. The picture shows a few of the many kinds.

Lobsters, crayfish, and crabs are fairly large animals. But some crustaceans are almost too small to be seen without a microscope. The water flea is one.

Crustaceans have two pairs of feelers, one pair longer than the other. They breathe mostly with gills. Some small ones have no special breathing organs.

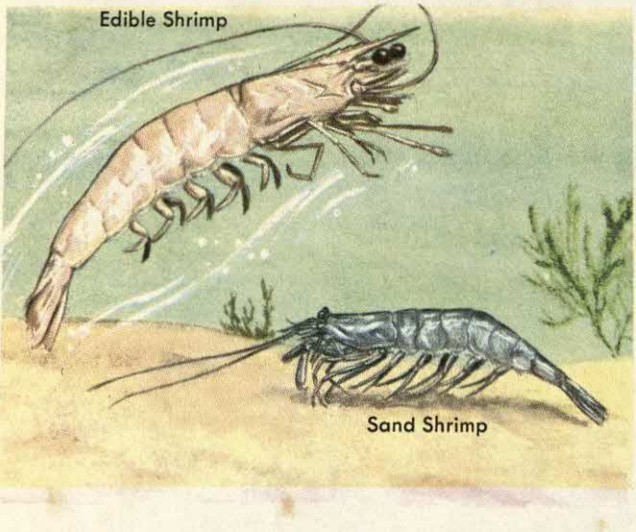
Most crustaceans live in salt water. There are many, too, in fresh water. The crayfish is found in ponds. And there are crustaceans that live on land. The pill bug and the beach flea are land dwellers.

Hermit Crab (in Moon Shell)

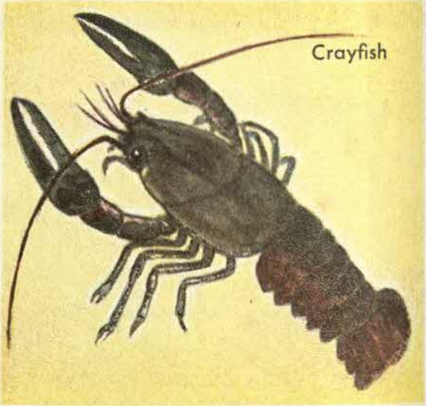
(out of Shell)

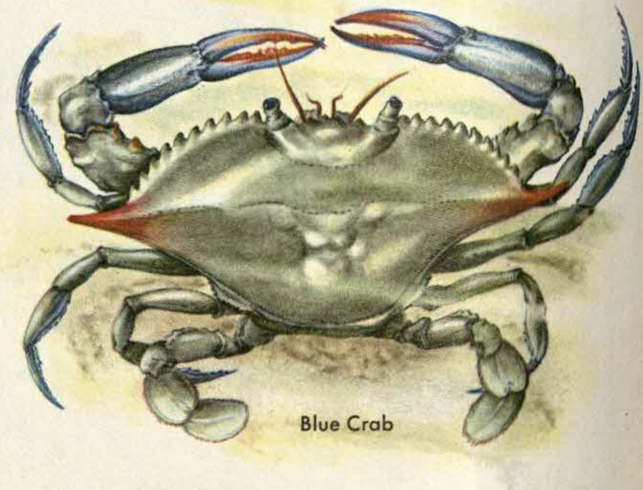
Sand Hopper

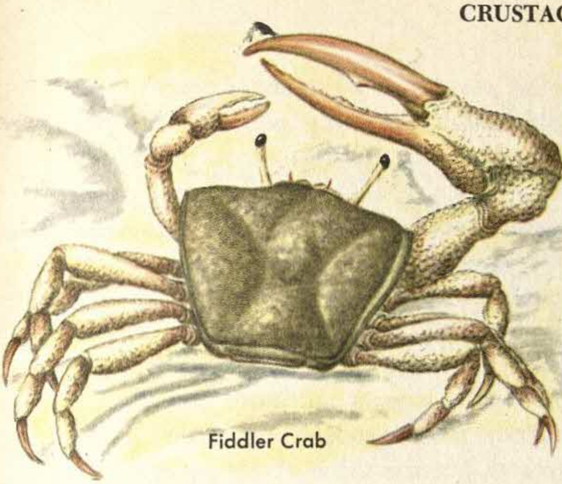
American Lobster


Edible Shrimp

Sand Shrimp


Crayfish


Blue Crab



Fiddler Crab

Crustaceans get their name from the covering, or "crust," which protects them. This suit of armor will not stretch. A crustacean as it grows must shed its covering from time to time and grow a new one. Part of a hermit crab is not protected with armor. A hermit crab makes a home in an empty snail shell.

Most crustaceans move about freely. Barnacles, however, fasten themselves to something solid when they are young and stay there the rest of their lives.

People eat lobsters, crabs, and shrimp. Even the crustaceans that we do not eat make good food for other animals. The very tiny ones are an important part of the "sea soup" many bigger animals live on.

Crustaceans have been on the earth for a very long time. But there were jointed-legged animals before them. Among them were the trilobites, the earth's leading animals half a billion years ago. (See BARNACLES; LOBSTER; TRILOBITE.)

CRYSTALS The pictures show several kinds of crystals. These crystals look as if someone had cut them into their shapes. But no one did. The minerals these crystals are made of form into these shapes without anyone's help. Every material that forms crystals has its own crystal shape.

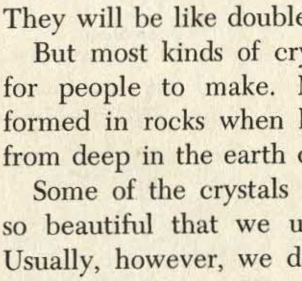
Crystals are common. Every snowflake that falls in the wintertime is made of tiny crystals of ice. The grains of salt in our saltcellars are crystals. Rock candy is nothing but big crystals of sugar. The sugar in our sugar bowls is made of smaller crystals. Grains of sand are crystals of quartz, but some have been battered about so much by wind and waves that their sharp corners and edges have been worn off.

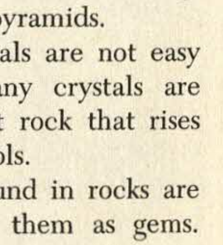
Some kinds of crystals are easy to make. Alum crystals, for instance, can be made in this way: First dissolve powdered alum in boiling water, putting in as much as the water will dissolve. Then hang a string down into the solution and put the solution aside to cool. Cool water cannot hold as much alum as hot water can hold. Some of the alum will form crystals on the string. They will be like double pyramids.

But most kinds of crystals are not easy for people to make. Many crystals are formed in rocks when hot rock that rises from deep in the earth cools.

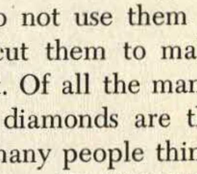
Some of the crystals found in rocks are so beautiful that we use them as gems. Usually, however, we do not use them in their own shapes. We cut them to make them the shape we want. Of all the many, many kinds of crystals, diamonds are the hardest. They are also, many people think, the most beautiful. (See DIAMONDS; GEMS; MINERALS; QUARTZ; ROCKS; SALT; SAND.)

Black Tourmaline

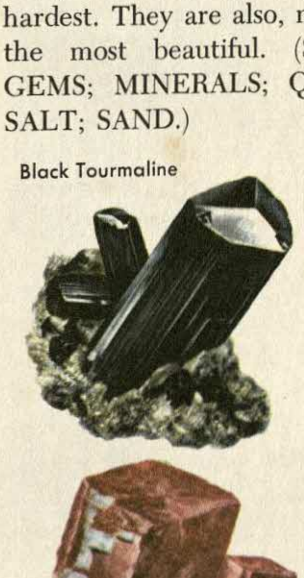




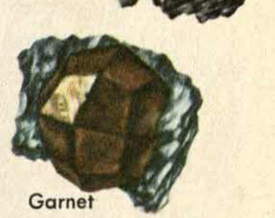
Beryl



Garnet



Rhodonite



Dogtooth Spar

CUBA This island neighbor of the United States is sometimes called the "Sugar Island." The name is a good one, for Cuba produces more sugar than any other country in the world. Of every ten acres that are farmed on the island, nearly seven are used for sugar. A person can drive for miles there through a sea of sugarcane.

Cuba is the biggest island of the West Indies; it is about the size of Tennessee. The island has many good harbors.

The climate of the island is excellent for sugarcane. Cuba is warm the year round. There is never any frost in its cropland. And rainfall is plentiful. Once in a while a hurricane strikes and does great damage. But Cuba is hit by hurricanes less often than some of its neighbor islands in the West Indies.

Cuba is chiefly an agricultural country. Four out of every ten workers work at raising crops. The soil of Cuba is especially good for sugarcane. It is also, however, good for tobacco, citrus fruits, pineapples, tomatoes, cotton, cocoa, corn, and coffee. Some areas are suitable for stock farms. A fiber crop, kenaf, has been introduced from the East Indies.

In one way it has not been good for Cuba to have its soil and climate so well fitted for raising sugar. So much land has been given to raising sugar that the prosperity of the island has depended entirely too much on the price of sugar.

In the past, even when sugar prices were highest, Cuba's working people were not as well off as one would expect. For much money from the United States and other countries had been put into the sugar plantations. Much of the profit, therefore, went to people who did not live on the island.

In recent years steps have been taken to change Cuba from a one-crop land. But the country still exports far more sugar than any other farm product. Tobacco is the runner-up, but the value of the sugar Cuba sells is more than 15 times the value of the tobacco.

Cuba is rich in some minerals. It exports copper, chromium, nickel, and iron ore. These ores bring the country about as much money as its tobacco.

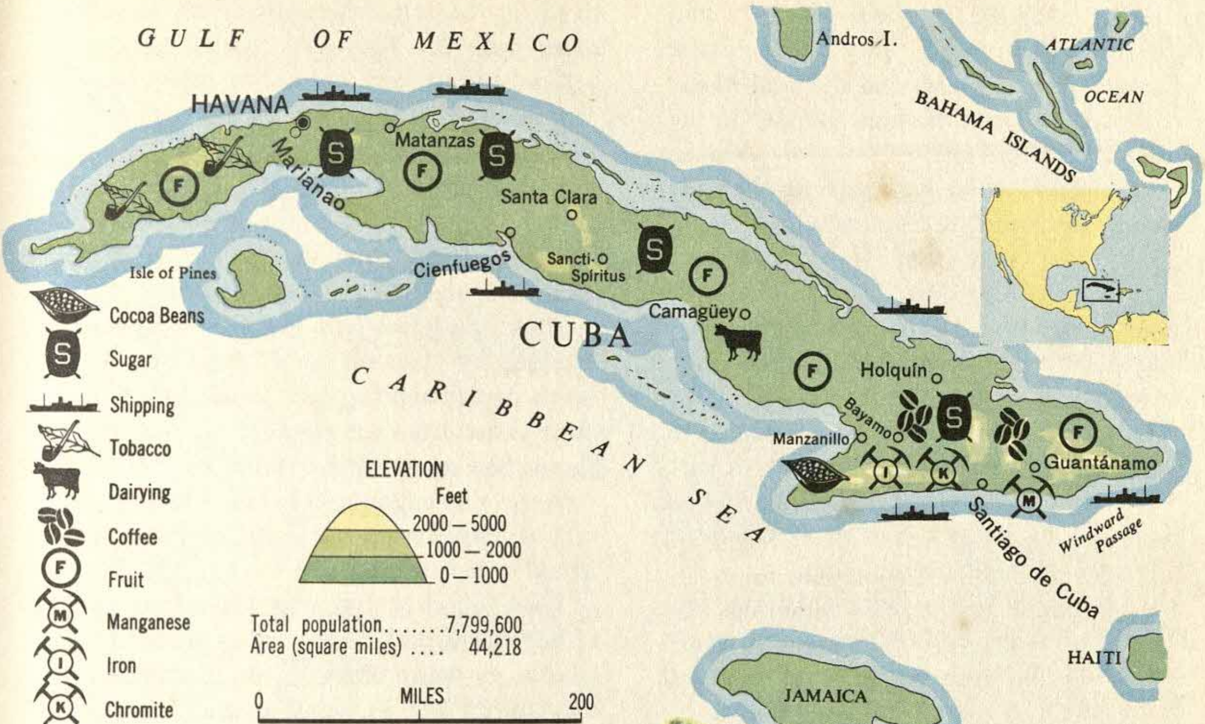
Some three-quarters of a million people live in Havana, the capital of Cuba. It has one of the finest harbors in the world. Long ago a large fort called Morro Castle was built to guard the entrance to the harbor from attacking pirates. The old fort still stands. Havana's factories are mostly cigar factories and sugar mills.

Spanish is the language of Cuba. Many Cubans speak English, too. Jai alai (HI a LI) and baseball are popular sports there.

Cuba has had a troubled history. Columbus discovered the island on his first voyage. He called it "the most beautiful land human eyes have ever seen." Soon other Spanish explorers reached its shores. It became a part of the Spanish empire.

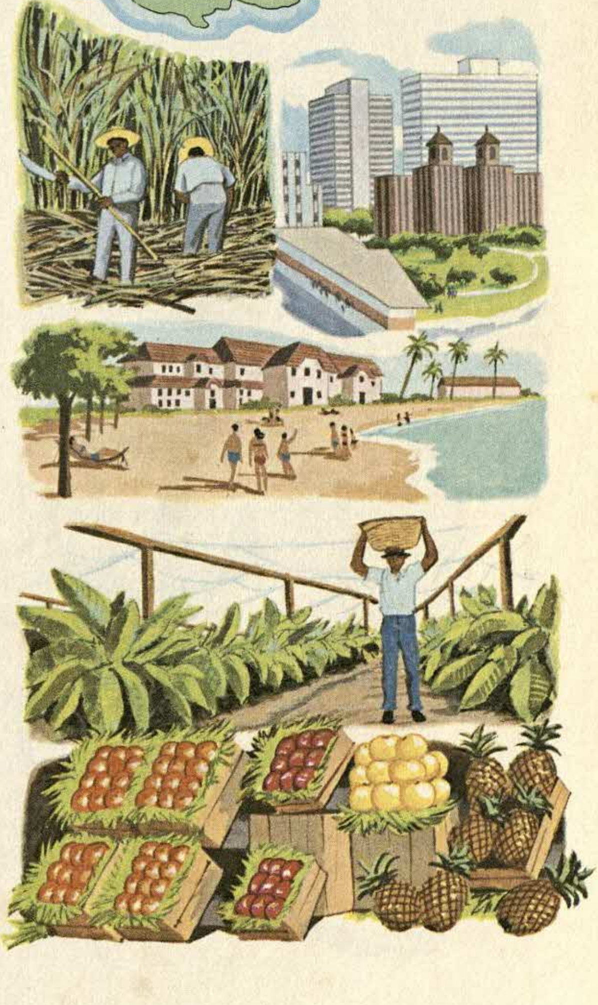
The Spanish rulers of Cuba did not rule the island wisely. Late in the 19th century Spanish rule became unbearable. The people of Cuba revolted. The United States helped the island win its freedom from Spain. Cuba became a republic in 1898.

Freedom meant much progress for the people of Cuba. Free schools were established for all Cuban children. Women as well as men were given the right to vote. Railroads and good roads were built to bring all parts of the island closer together. Wages and working conditions improved.



But Cuba, after it won its freedom, did not always have good government. Finally one of its presidents, General Batista, became a dictator. In 1957 some Cubans became so unhappy with their government that they revolted. Fidel Castro led the revolution, which ended successfully in 1959. One of the first steps the new government took was to pass laws to break up big land holdings. The government, moreover, began to take over Cuban businesses owned by people of other countries. Castro soon showed himself unfriendly to the United States, claiming that the United States was trying to overthrow his government.

In 1961 Castro proclaimed Cuba a Communist country. Since that proclamation Cuba has had little to do with any countries except other Communist countries. In 1958 about three-fourths of its trade was with the United States. Now more than four-fifths of it is with Communist nations. The Soviet Union and China are Cuba's best customers and in turn sell a great deal to Cuba. Cuba is the only Communist country in the western hemisphere.



CURIE, MARIE (1867–1934), and **PIERRE** (1859–1906) The name Curie is famous. Pierre Curie and his wife Marie discovered radium. Radium is one of the earth's rare elements.

Marie Sklodowska was born in Warsaw, Poland. She had three sisters and a brother, all older than she. The family was happy even though they were poor. But when Marie was eight, her oldest sister died. Two years later her mother died. Marie, however, was able to stay in school. When she finished high school she was given a gold medal for her good work.

Now Marie set to work to help her sister, Bronja, go to college. She gave lessons to the children of wealthy families.

By the time Marie was 24, Bronja had become a doctor and was married. Marie went to Paris to live with her and to attend the Sorbonne, a famous university.

After a few weeks Marie decided that she would have more time to study if she lived by herself. She moved to an attic room near the university. Often now she had only dry bread and tea to eat. A bunch of radishes or a bit of chocolate was a real treat. She studied very hard.

Then one day Marie met Pierre Curie, a French scientist and professor. They fell in love and were soon married. Two years later their daughter Irène was born.

Marie had become interested in some strange rays certain rocks gave off. After much experimenting she decided that they must come from an element no one knew about. She made up her mind to find it.

Pierre was eager to help her. They agreed that if they found the new element they would call it radium.

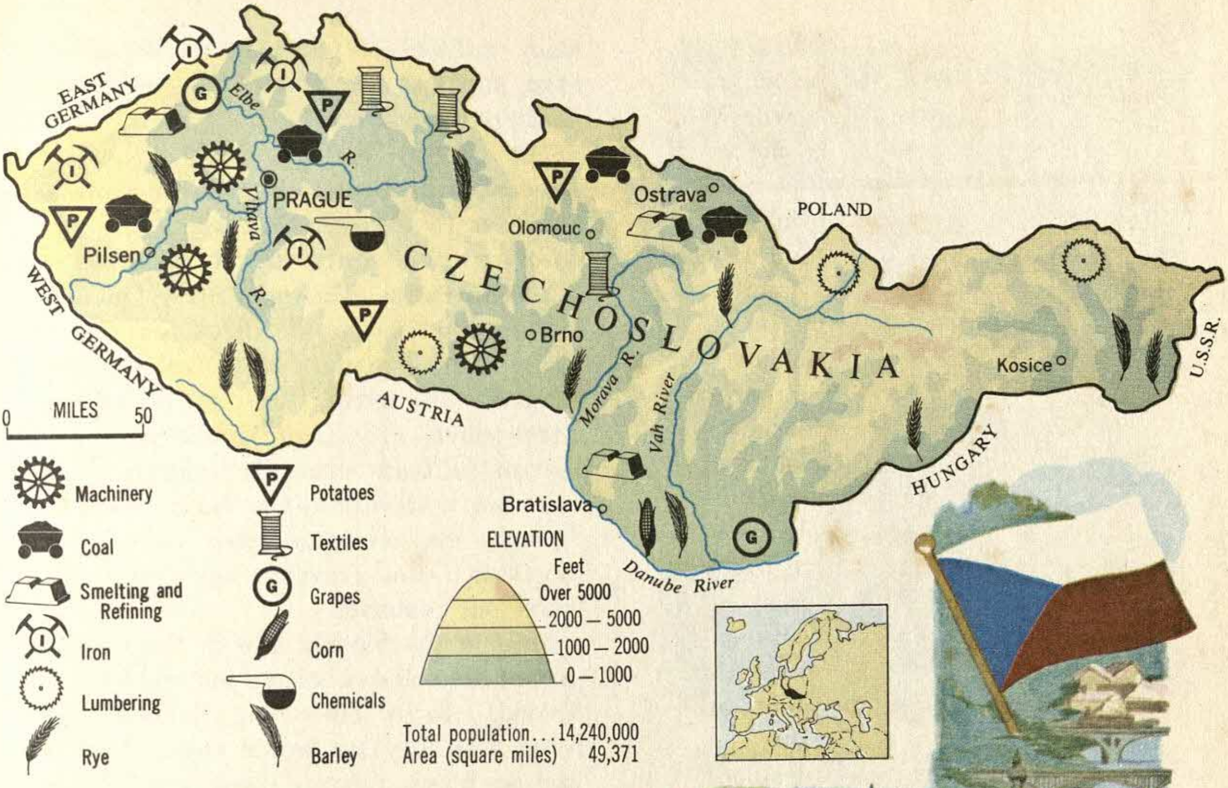
They found it, but only after four years of very hard and discouraging work. Their laboratory was a leaky shack. It was almost unbearably hot in summer and miserably cold in winter. The Curies had decided to try to get radium from a rock called pitchblende. They had to handle tons of it.

Marie and Pierre knew that they had at last got a tiny bit of radium when they went back to their laboratory one night. The radium was glowing in the dark!

The Curies were given many honors. All the world praised them.

Soon after they made their famous discovery, a second daughter, Eve, was born. She was only two when Pierre was struck by a horse-drawn wagon and killed. Marie took her husband's place as a professor.

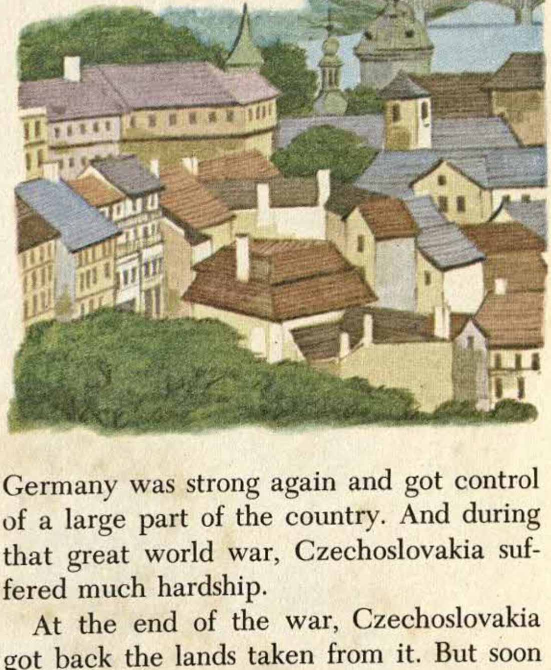
Even though she had discovered radium and had showed others how to get it, Marie could buy very little of it for her own use in carrying on experiments. It was very, very expensive. She made two visits to America. Each time, to honor her, the American people gave her a gift of radium worth many thousands of dollars. With this radium she could continue her experiments. When she was 67 she died from the effects of too much exposure to radium, the very element that had made her world famous. (See ELEMENTS; RADIUM.)



CZECHOSLOVAKIA When peace was made at the end of World War I, several new countries were formed in Europe. One was Czechoslovakia. A small part of this new country was carved out of Germany, a country defeated in the war. But most of it had been in Austria-Hungary, another of the defeated countries.

For centuries, Czech people and Slovak people had lived in the part carved from Austria-Hungary. The Czechs and Slovaks are closely related. Their languages are much alike. All through the time they had lived in Austria-Hungary, they had kept on using their own languages. And they had hoped very much to have a country of their own. Since the new country was the home of the Czechs and the Slovaks, it was named Czechoslovakia.

The people of the new Czechoslovakia decided that it would be a republic. They began at once to work to make their country one they could be more and more proud of. They worked successfully for almost 20 years. Then, just before World War II, Germany was strong again and got control of a large part of the country. And during that great world war, Czechoslovakia suffered much hardship.



At the end of the war, Czechoslovakia got back the lands taken from it. But soon the influence of the Soviet Union was so powerful that a Communist government was set up in Czechoslovakia. Today two-thirds of the country's trade is with its Communist neighbors.

Czechoslovakia is almost exactly the size of the state of New York. It has almost as

many millions of people, too. Mountains form most of the country's western and northern boundaries.

The country is landlocked: it has no seacoast at all. But two great rivers form highways to the sea. One is the Elbe. It flows from the western part of the country to the North Sea. The other is the Danube. It flows southeast to the Black Sea, and is the southern boundary of central Czechoslovakia. Bratislava, the third biggest Czechoslovak city, is a Danube port. Important railroads cross the country. One that runs northeast to the Baltic Sea goes through the mountain pass called the Moravian Gate. Travelers have used that "gate" for centuries.

Most of the Slovaks live in the eastern part of the country, known for centuries as Slovakia. In it cities and factories are fewer than they are farther west. The Slovaks are mostly farmers, shepherds, lumbermen, or miners. But manufacturing is growing. The beautiful scenery in the Tatra Mountains attracts many vacationers.

Most of the Czechs live in the richer western part of the country in the areas long called Bohemia, Moravia, and Silesia. Here there are fine forests, good farmlands, great stores of iron not far from coal, clay suitable for china, and sand suitable for glass. The region has silver, aluminum, uranium, copper, lead, and rock salt, too. Its Lenin steel mills are among the largest in Europe. From its many factories come glassware, porcelain, shoes, textiles, chemicals, sugar, and beer. Its farms produce hops for beermaking, sugar beets, potatoes, barley, wheat, and rye.

Long ago, Bohemia was a kingdom. Its capital was Prague. Today Prague is Czechoslovakia's capital and its biggest city. It is on both sides of the Vltava (Moldau) River. The palace that was once the home of the kings of Bohemia is still standing. So is Charles University, founded in 1348. Parts of this interesting old city are bustling and modern. Parts are quaint and quiet.

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